FEB 20 1928

THE ARCHITECTURAL FORUM

IN TWO PARTS

PART ONE
ARCHITECTURAL DESIGN

FEBRUARY

1928

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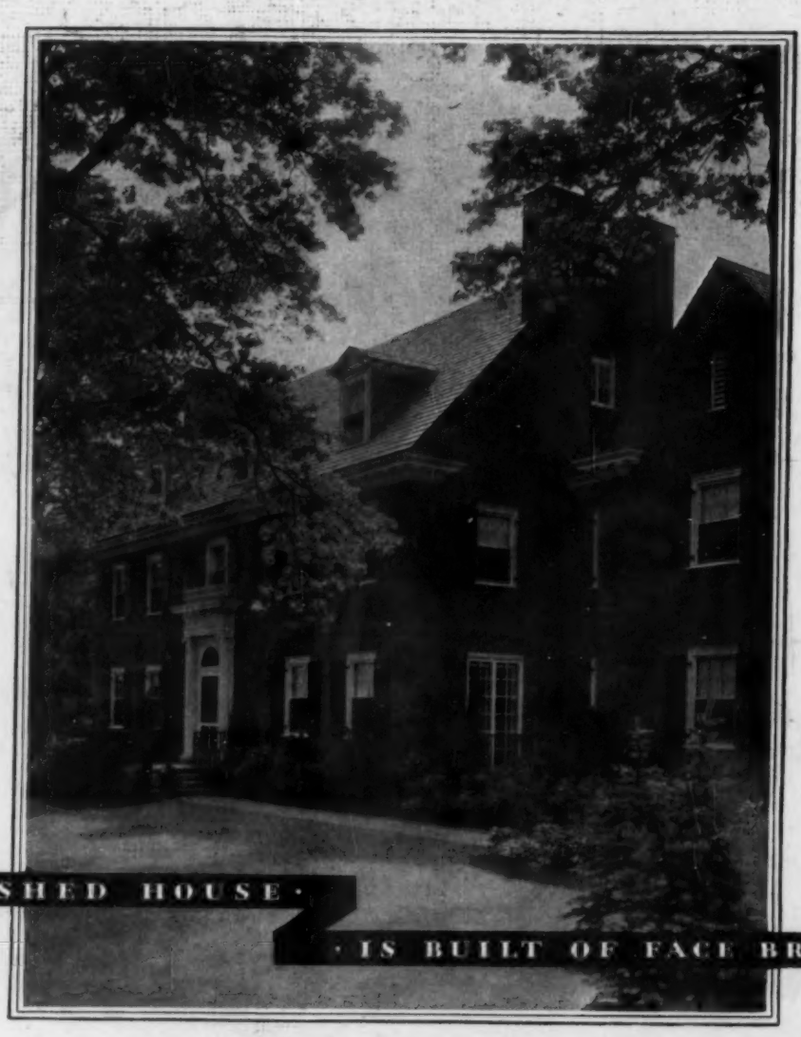

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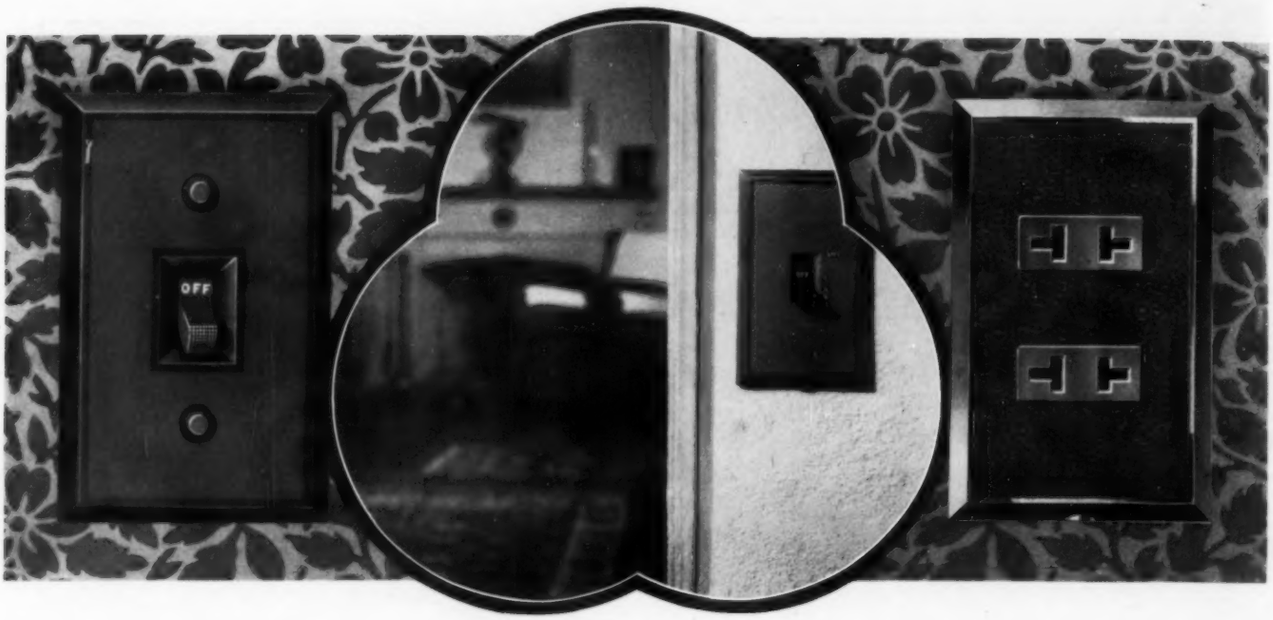

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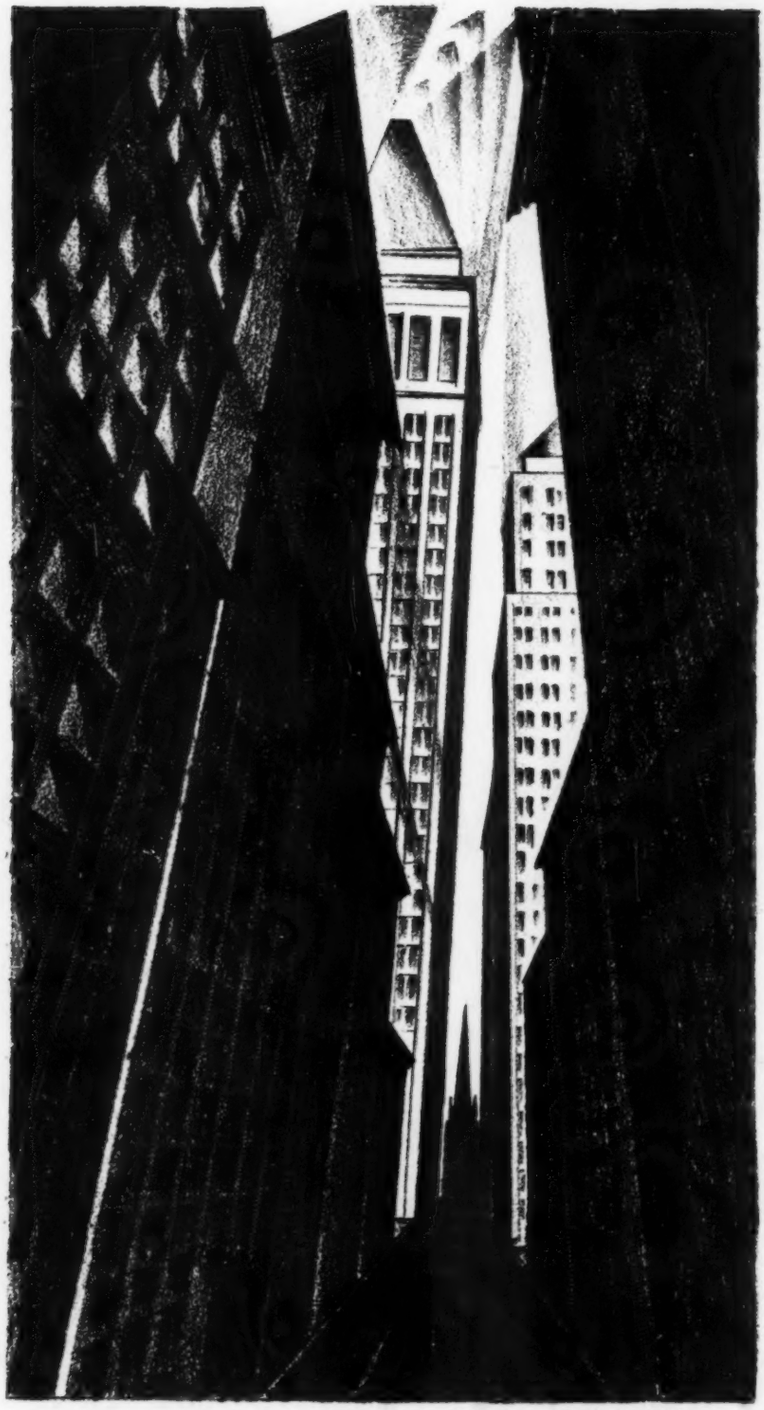


Courtesy of E. Weyhe, Publisher

WALL STREET ON SUNDAY

FROM A LITHO PENCIL DRAWING BY
ARNOLD RONNEBECK

The Architectural Forum

UNIV. OF MICH.

THE
ARCHITECTURAL
FORUM

VOLUME XLVIII NUMBER TWO

FEBRUARY 1928

MODERN ARCHITECTURAL DECORATION

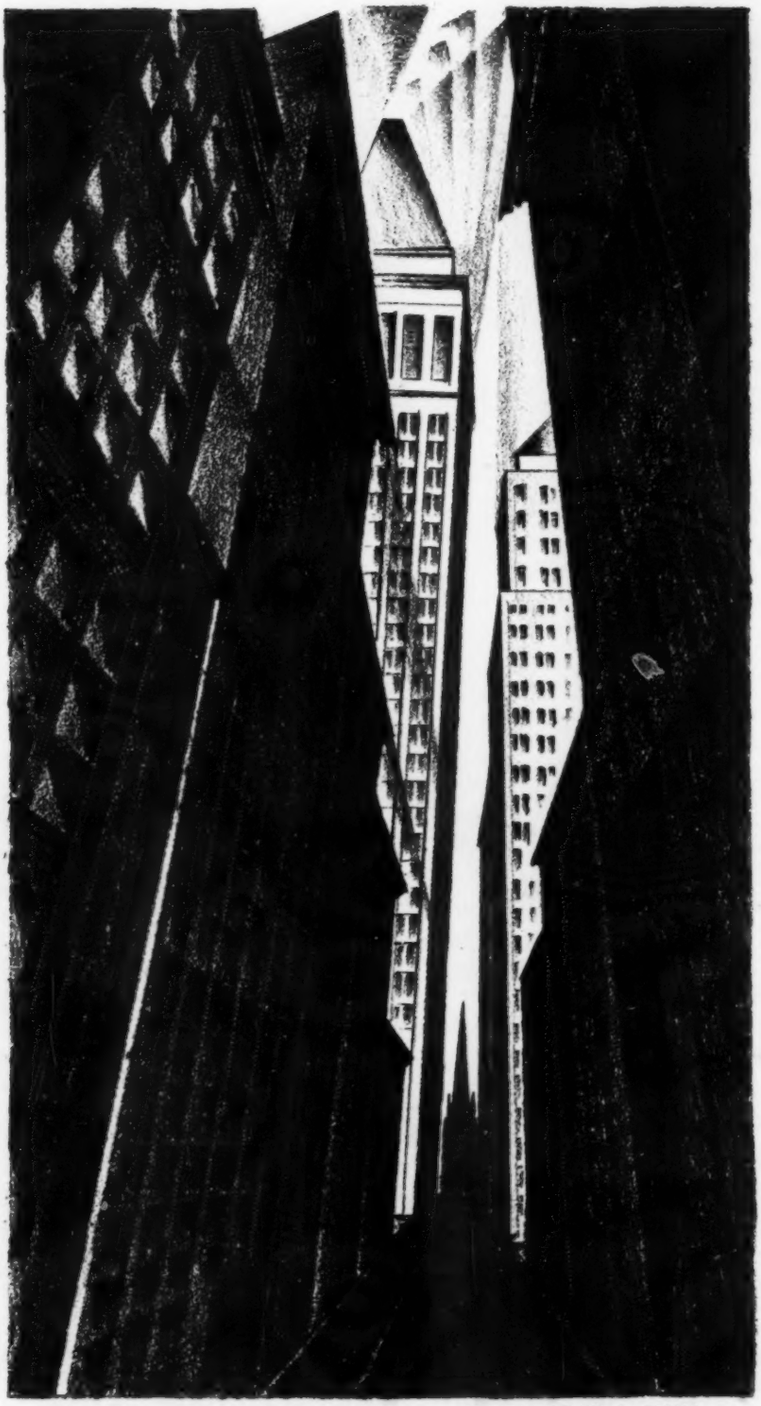
BY
PARKER MORSE HOOPER

CONVENTIONALIZATION, geometrical and floriated designs, compositions in pure line, mass and color that have no representative significance, are all found in the wide range of modern architectural ornament and decoration. Nearly always the decorative element is stronger than in the ornament of any of the historic periods. That is to say, the composition, in mass, tone, line or color, for the sake of its own effectiveness or beauty, is the main thing. What, if anything, it may suggest or represent is a relatively unimportant matter. Frequently one cannot tell whether a piece of ornamental detail was inspired by a flower, a figure from animal life, or is purely a composition in line, tone or color. This is the pronounced and most salient characteristic of modernist detail.

The sources of inspiration, where such exist, are often found in the art of little known civilizations long since dead, or in the art of distant peoples. This choice is dictated partly, no doubt, by a desire to get away from the familiar forms of classic and mediæval design and their western European derivatives, but it is also due to a recognition of certain inherent qualities of these ornamental styles. Thus we often find in modern detail a strong resemblance to the carvings in low relief that adorn the walls of ancient Assyrian tombs and Egyptian temples, or to the stone sculptures of the Maya culture of Central America. Then, too, some of this ornament is akin to the carving on the canoe paddles of the South Sea Islanders, or to the crude symbolic representations which are familiar features of the totem poles of the Indians of Alaska. All of these various types of ornament have certain marked characteristics in common,—namely, breadth and simplicity of treatment, and above all a strongly decorative character. When considered purely as arrangements of lines, tones or colors, without thought as to what they may represent or of any symbolic significance or other interest that may attach to them, they are highly effective. They serve splendidly to enrich the surfaces upon which they are wrought, which after all is the chief purpose of any architectural decoration and ornamentation, and often their only purpose, though sometimes they tell a story or suggest the character of some natural form as well, giving added enrichment.

As a matter of fact, it is more the method of composing ornament and the manner of carving, modeling or painting it broadly and decoratively that modern designers have taken from the art of the Assyrians, the Egyptians, the South Sea Islanders, the Mayas, the Alaskan Indians and various other sources, than any ornamental forms. They have taken the essential characteristics of their technique rather than the designs themselves. In the Egyptian and in the archaic Greek carvings in stone our sculptors are finding the masterly handling of the material that serves as a guide in their own work,—methods of producing crispness, boldness, softness, or whatever effect they wish to convey in their decorations. Much of the detail in the modern style is purely decorative in the sense just defined. It consists often of carving done only for the purpose of producing a play of light and shade in areas of a certain desired form at points on the building where this relief or accent seems to be needed. Sometimes color is used in the same way. The ornamental detail of most buildings in the modern style is a more intimate part of the structure than is the ornamentation of most of the buildings of earlier times, with the possible exception of the work in Assyria and Egypt already referred to. Usually the ornament could be stripped from a Gothic or Renaissance building, for instance, without destroying the composition of the whole; it might be removed as one might rip off a band of embroidery from a Renaissance vestment without destroying the garment. But in the best of the thoroughly modern designs the detail is an integral part of the composition.

Modern decoration is often in low relief, sometimes painted or executed in colored tile and terra cotta, rather than in high relief carving or in the round. This is no doubt due to the recognition of the wall surface as the main thing, a plane that is not to be denied, but to be worked in, not upon. Modern ornamentation is not an incrustation, usually, as much of the detail of past centuries is. This is in consonance with the idea of simplicity that is strong in modern design. It is also in agreement with one of the essential characteristics of modern steel-frame



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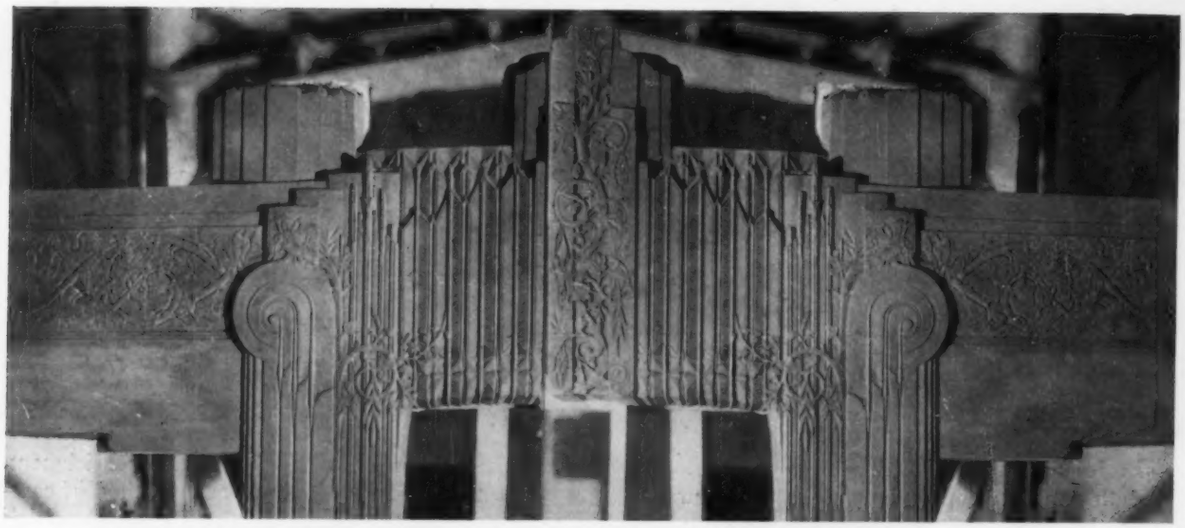
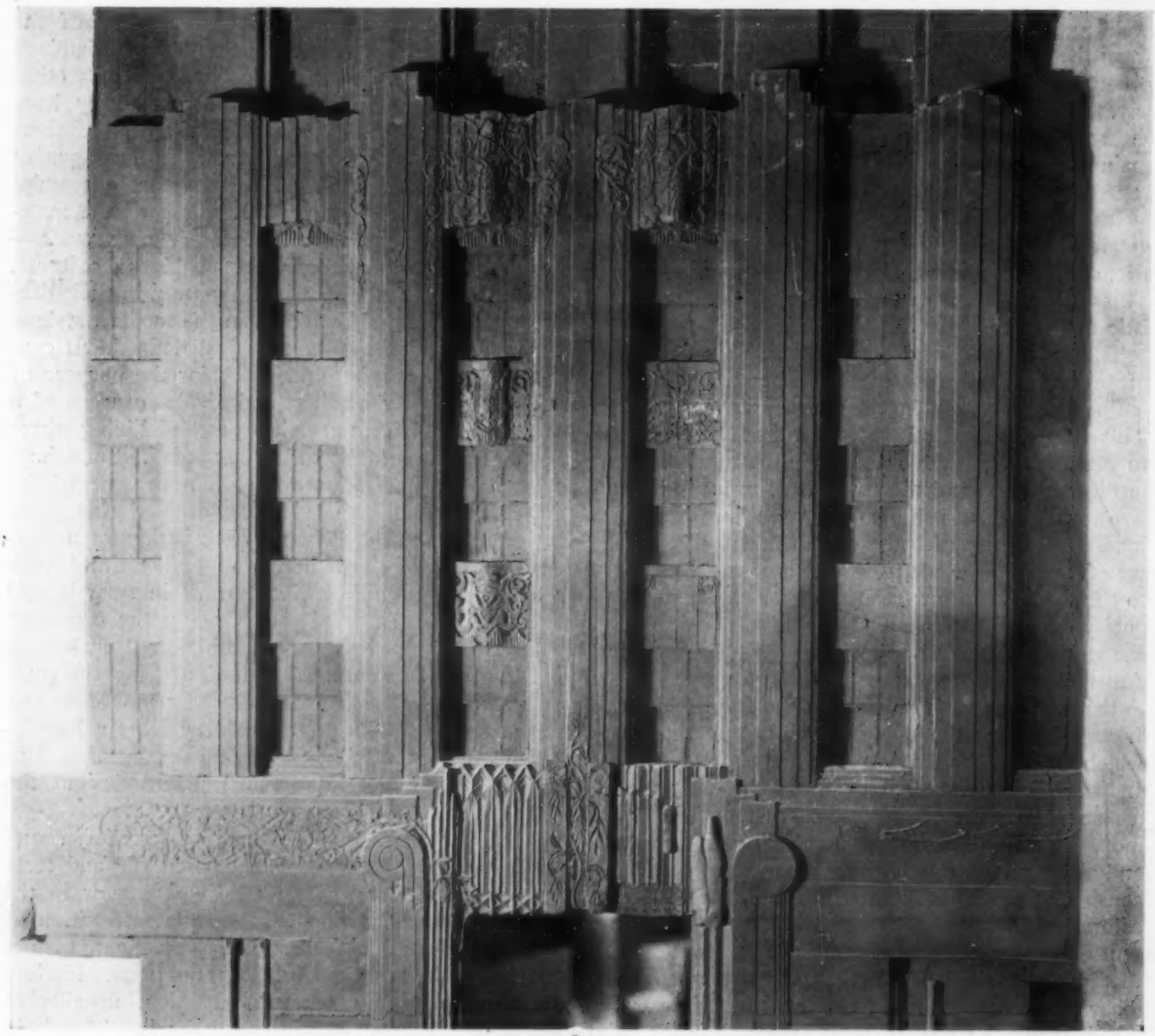
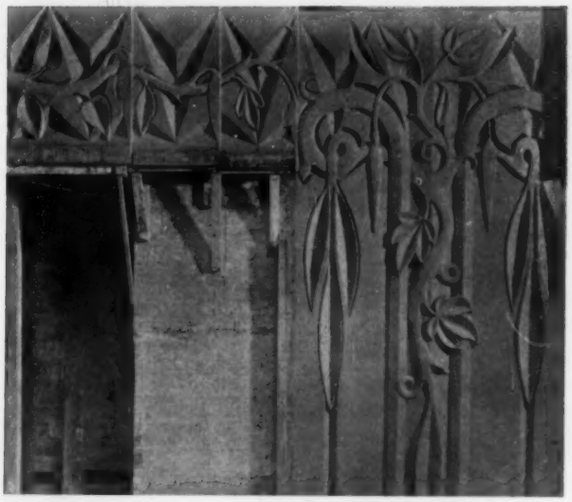




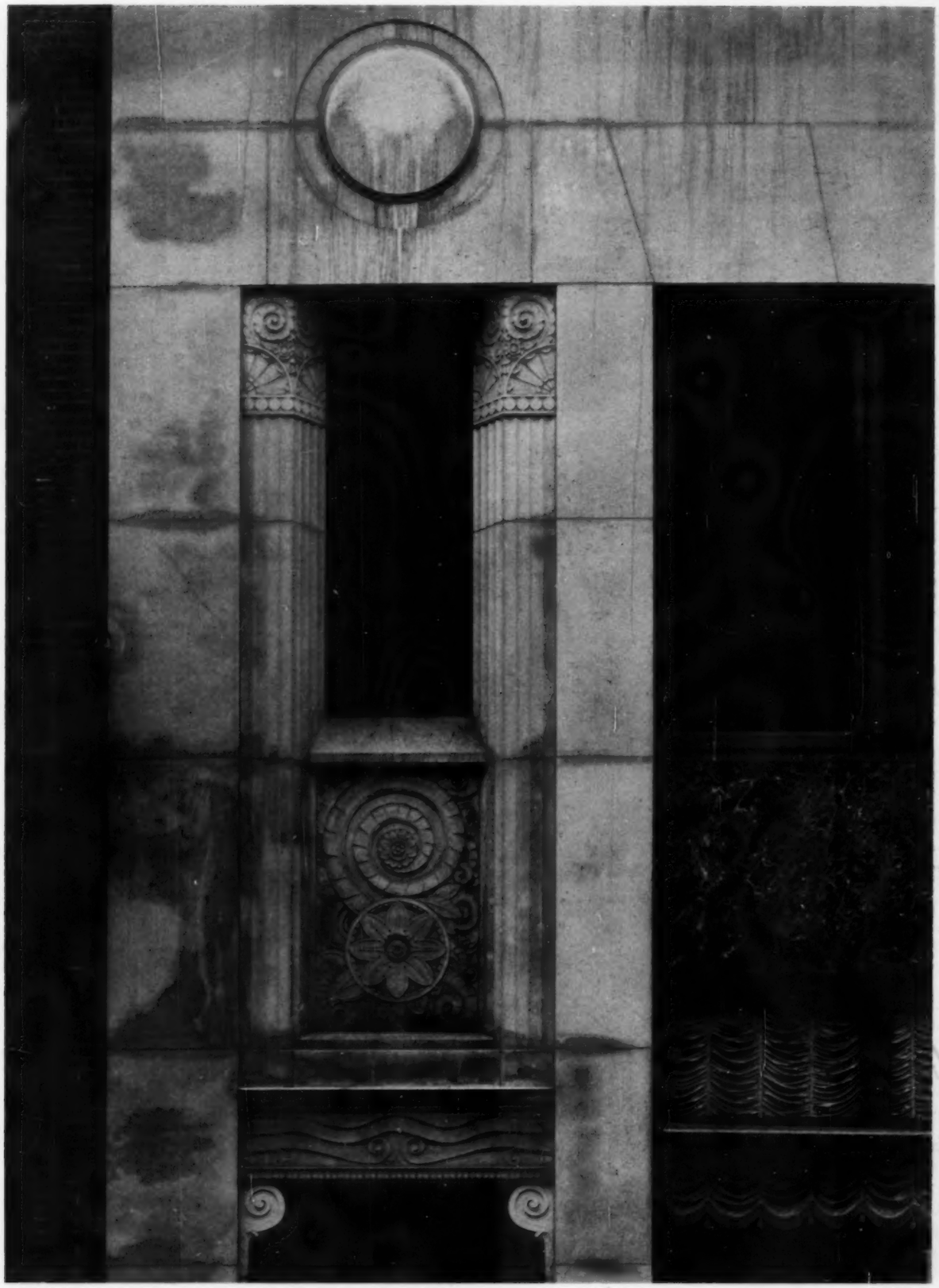
Models in Clay for the Decorative Treatment of the Lower Stories and Main Entrance of the New Jersey Bell Telephone Building, Newark

Voorhees, Gmelin & Walker, Architects



Editor's Note: These Models in Clay of Decorative Details for the New Jersey Bell Telephone Building, Newark, are all Splendid Examples of the New Use of Geometrical and Floriated Designs in Consistent Rhythmic Combination. In Place these Decorations Seem to Grow Out of the Structure of the Building of Which They Are a Part

Voorhees, Gmelin & Walker, Architects



Editor's Note: Although Inspired by no Particular Period of Architectural Decoration, the Motifs of this Richly Carved Panel and Splayed Jamb-head Are Suggestive of Ornamentation Found in Archaic Greek and Early Chinese Designs. Architects Have Struck a New Note in this Example of Conservative Modern Decoration

Dennison & Hirons, Architects

Restraint and Character Are Shown in the Modern Decorative Treatment of the Narrow Entrance Bays of No. 420 Madison Avenue, New York

Dennison & Hirons, Architects

The Simplicity of the Decorative Treatment of this Entrance of the Graybar Building, New York, Illustrates a Successful Use of the Modern Style of Architectural Decoration

Sloan & Robertson, Architects

Editor's Note: A Combination of Panels of Colored Faience, and Conventional Symbolical Figures and Decorative Lettering, Deeply Cut into the Stone Wall of the Graybar Building, Exemplify the Conservative Type of Modern Architectural Decoration

Sloan & Robertson, Architects

buildings,—the thin walls, upon which ornament that is flat or in low relief is most suitable. When sculpture in high relief or in the round is employed, the practice is made consistent with the modern idea that all architectural decoration and adornment should be treated as an integral part of the structure, a part of the carving of a great piece of craftsmanship which happens to be a building. This is often done by carving the details on parts of the solid mass of masonry and leaving them as though the work had been stopped before the complete figure had been carved, like partly finished statues emerging from the sculptor's block of marble.

There is a difference in the distribution of the detail on characteristic modernist buildings, for it is localized in spots, usually, instead of being used largely in string and belt courses, in cornices and entablatures, in spandrels and panels as is the common practice in the enrichment of most buildings based on historic precedent. As far as detail other than ornament is concerned, but little is used. The orders and other architectural forms on modernist buildings are not consistent with the new style, and when attempted they are ornamented in accordance with the methods already discussed. The detail of modernist buildings is essentially decorative rather than architectural in the sense of being derived from construction forms applied as decoration. Color is becoming more and more a prominent part of modern architecture and is being used constantly, as are the other elements, as a part of the whole scheme of the building. Often, as in the case of a number of buildings by Buchman & Kahn, illustrated in the January issue of THE ARCHITECTURAL FORUM, color is an outstanding feature of the design, and is needed in our city buildings as a relief from the monotony of dull-toned materials. The city dweller is deprived of the varied coloring of the country, so the use of color in architecture is the only possible substitute. Also, color has the power of doing many things besides giving pleasure in itself. It can, for instance, through the use of dark colors at the base of our buildings, relieve the sense of confusion in the streets, while the use of light colors on the upper parts of tall buildings can relieve the sense of oppressiveness and overpowering masses of the towering structures all about us.

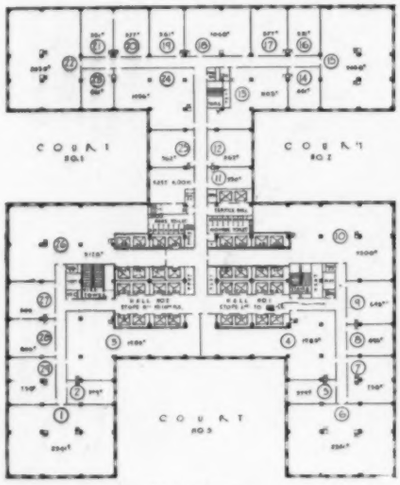
The use of color is still in an experimental stage, and has great possibilities as a legitimate and consistent means of decorating high buildings. But first comes the study of the main problem, the designing of masses expressive of present-day conditions and requirements, upon which is based sound and legitimate development of modern architectural design.

An Unusually Interesting Treatment Gives Variety and Decoration to the Lower Stories of the Graybar Building, New York

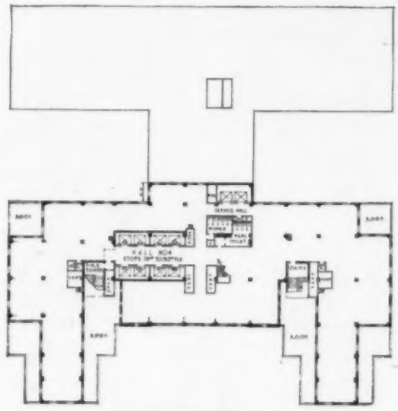
Sloan & Robertson, Architects

Photo. Wurts Bros. *Plans on Back*

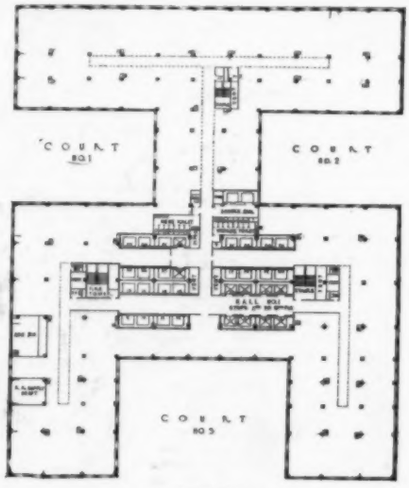
GRAYBAR BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS



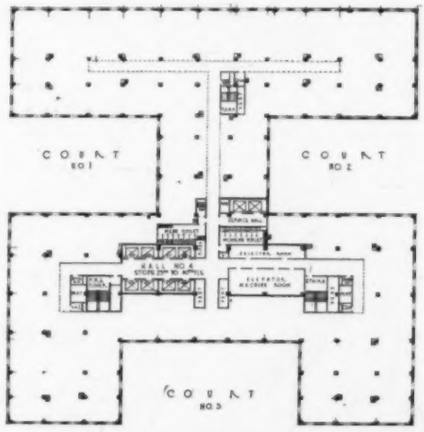
Eighth Floor



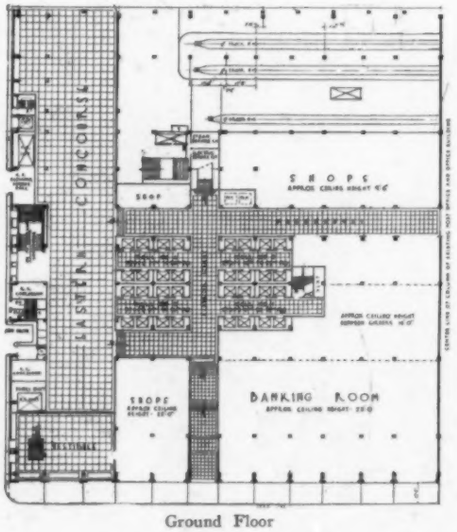
Thirtieth Floor



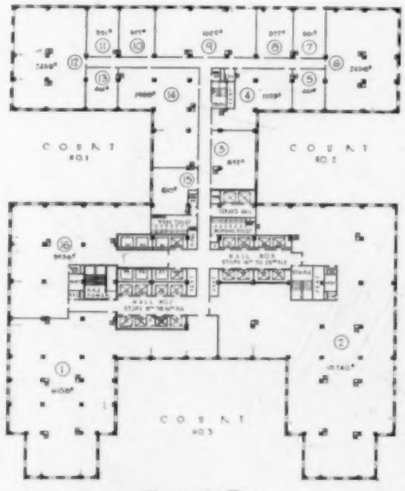
Third Floor



Twenty-fifth Floor



Ground Floor



Sixteenth Floor

PLANS, GRAYBAR BUILDING

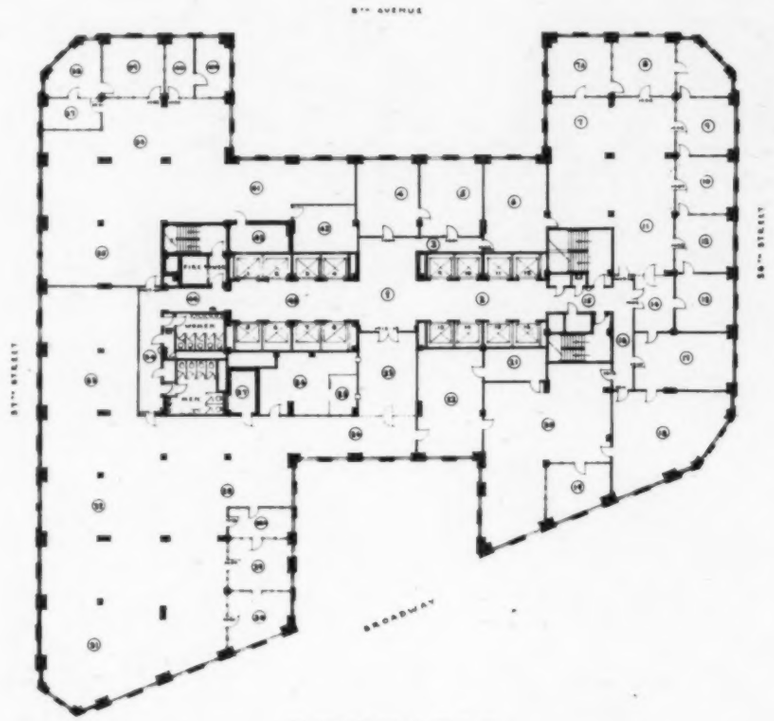
SLOAN & ROBERTSON, ARCHITECTS

Photos. Sigurd Fischer

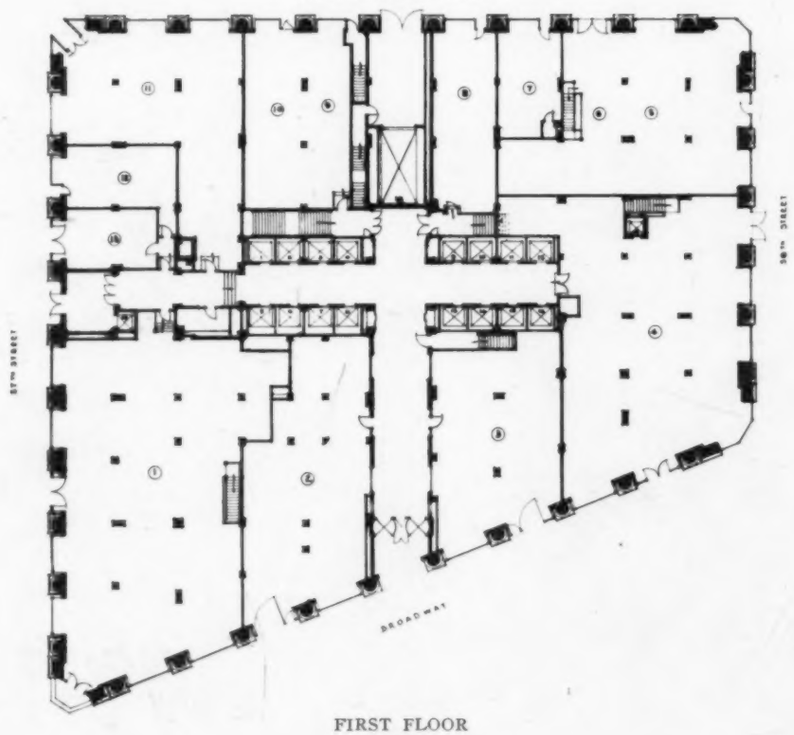
Plans on Pages 164 and 166

GENERAL MOTORS BUILDING, NEW YORK

SHREVE & LAMB, ARCHITECTS

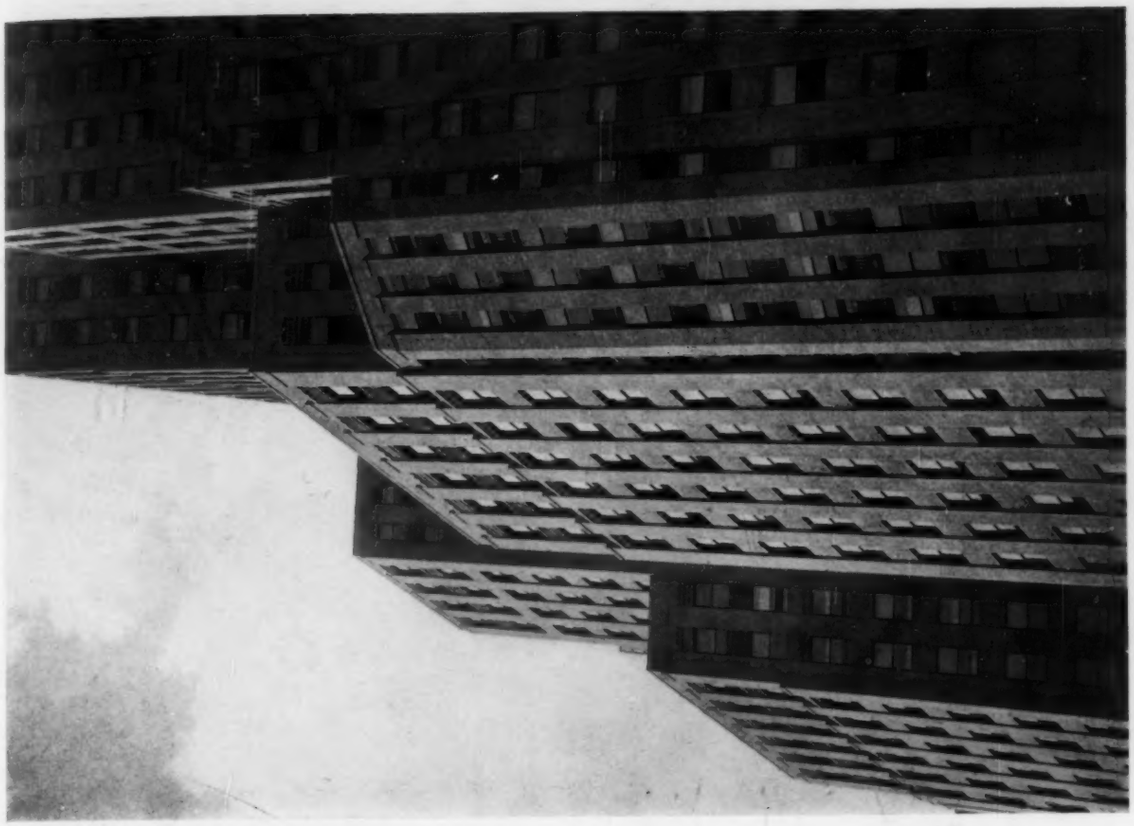


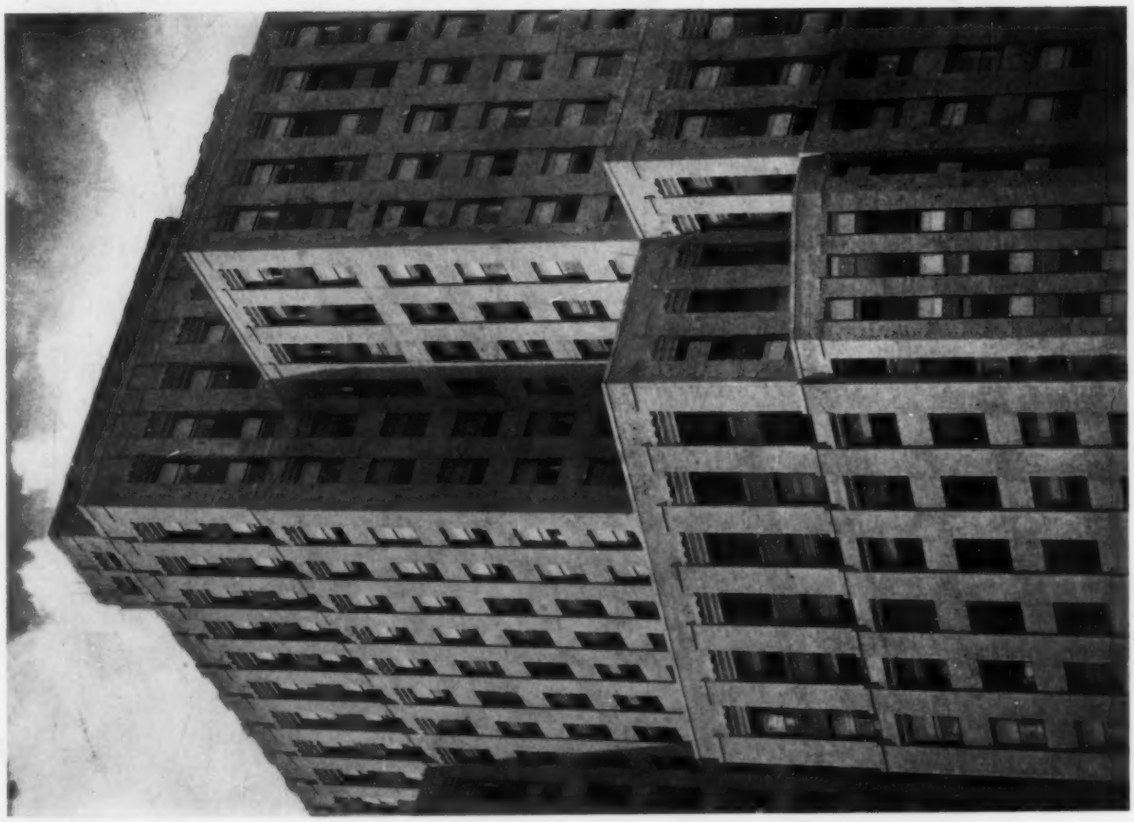
FOURTEENTH FLOOR



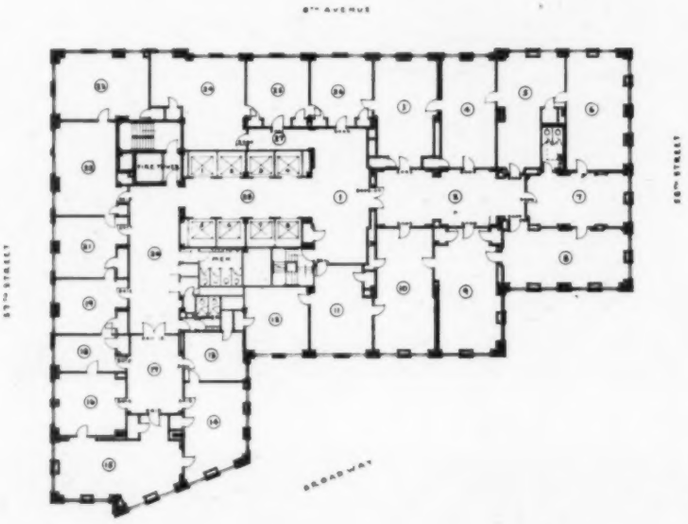
FIRST FLOOR

PLANS, GENERAL MOTORS BUILDING, NEW YORK
SHREVE & LAMB, ARCHITECTS





THE INTERESTING ARRANGEMENT OF THE SETBACKS IS DUE TO THE IRREGULARITY OF THE SITE
GENERAL MOTORS BUILDING, NEW YORK
SHREVE & LAMB, ARCHITECTS



TWENTY-FOURTH FLOOR

PLANS, GENERAL MOTORS BUILDING, NEW YORK

SHREVE & LAMB, ARCHITECTS

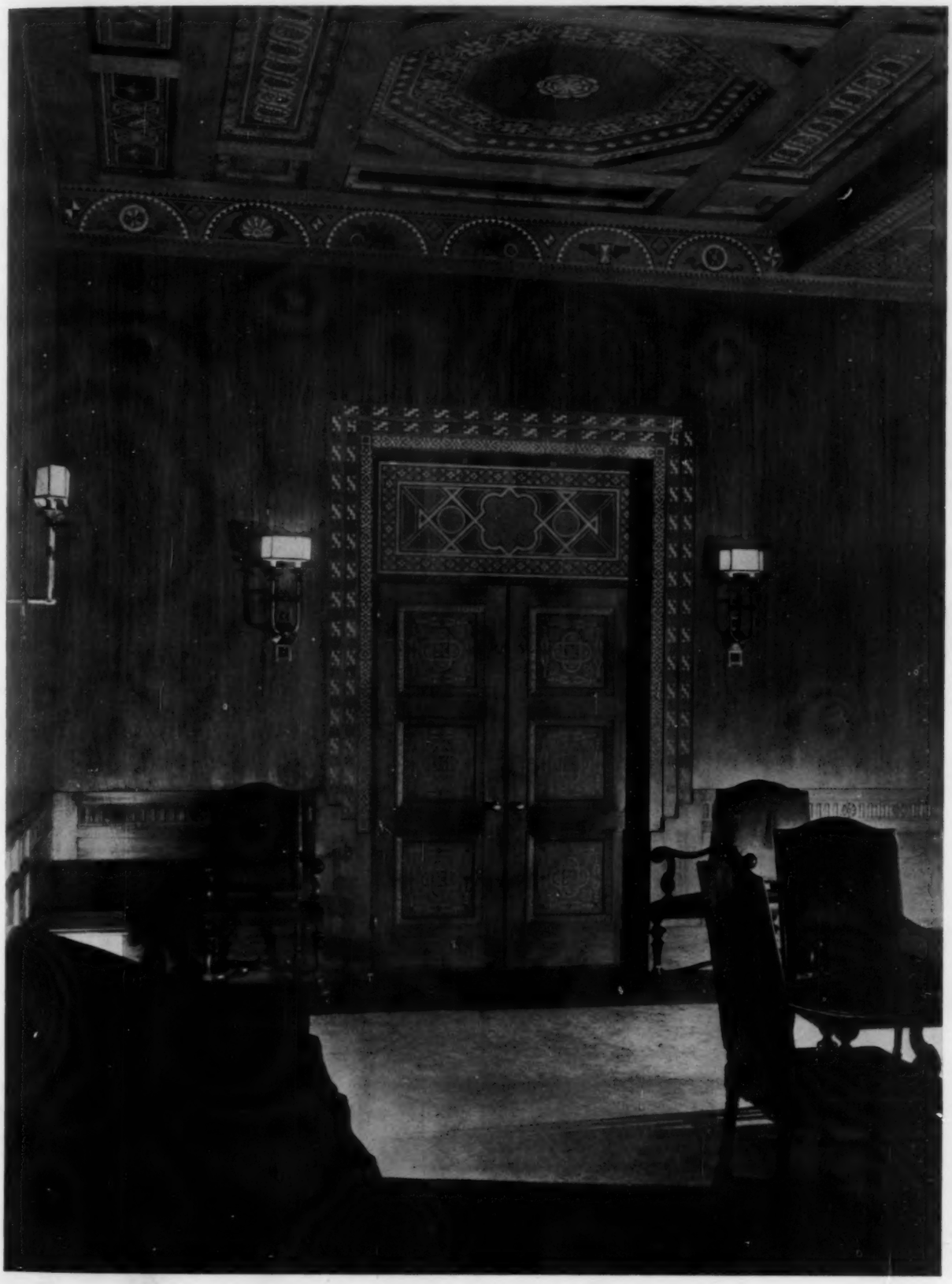
SECRETARY'S ROOM, TWENTY-FOURTH FLOOR

MAIN DINING ROOM, TWENTY-SIXTH FLOOR

GENERAL MOTORS BUILDING, NEW YORK

SHREVE & LAMB, ARCHITECTS

DETAIL OF BOARD ROOM CEILING
GENERAL MOTORS BUILDING, NEW YORK
SHREVE & LAMB, ARCHITECTS



DETAIL OF BOARD ROOM
GENERAL MOTORS BUILDING, NEW YORK
SHREVE & LAMB, ARCHITECTS

TELEPHONE ROOM, TWENTY-SIXTH FLOOR

PRIVATE DINING ROOM, TWENTY-SIXTH FLOOR

GENERAL MOTORS BUILDING, NEW YORK

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A GREEK REVIVAL COURT HOUSE IN SOUTHERN INDIANA

BY
REXFORD NEWCOMB
PROFESSOR OF ARCHITECTURE, UNIVERSITY OF ILLINOIS

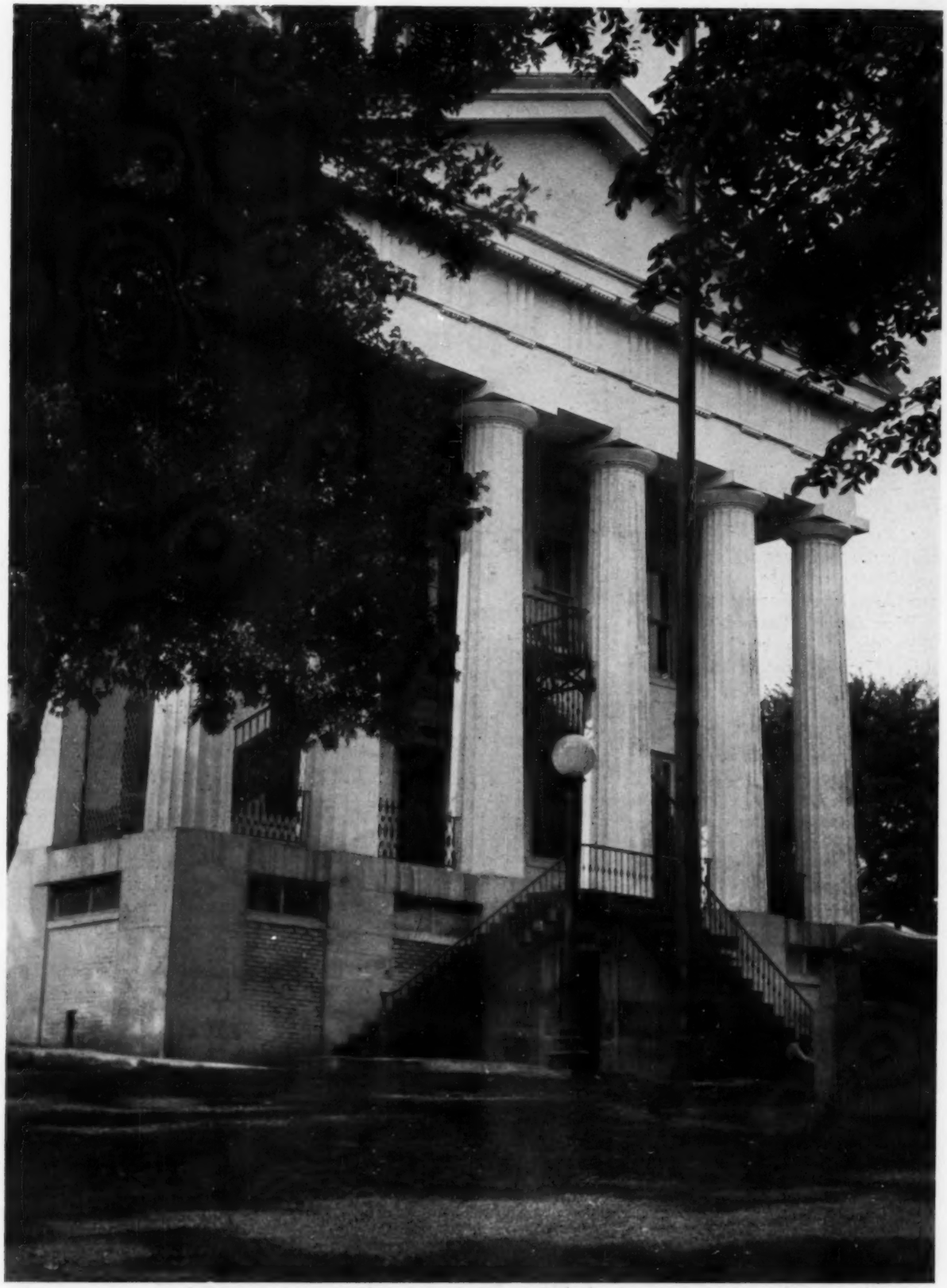
THE Greek Revival movement in the history of American architecture was an interesting and far-reaching development. While I think it is correct to say that a way was prepared for it by the slightly earlier "Classic Revival," which was a style of Roman rather than Greek inspiration, it has always seemed to me that the Greek Revival brought to an end a worthy movement that arrived in America with our earliest English forefathers and came to flower with excellent examples of the American Georgian, in New England, the middle states, and the south. Indeed, these Colonial-Georgian types found their way over the mountains, and the middle west, parts of Illinois, Ohio, Michigan, and particularly Kentucky, are not without excellent examples of this early American style, which, becoming acclimated along with our forefathers, in time took on an almost indigenous character. But the "Colonial," which began to forge for itself an expressive set of characteristics long before the end of the seventeenth century and which, by virtue of a growing classicism, gradually became an adequate, if belated, American reflection of English Georgianism, was to come to an end, and that almost by accident, about 1800. The movement which terminated this interesting expression of early American life in architectural form was, after all, again only an American reflection of a corresponding movement in Europe, particularly in England and in Germany, where a decided vogue for the Greek was then in progress.

North End, Showing Wide Pilaster Treatment

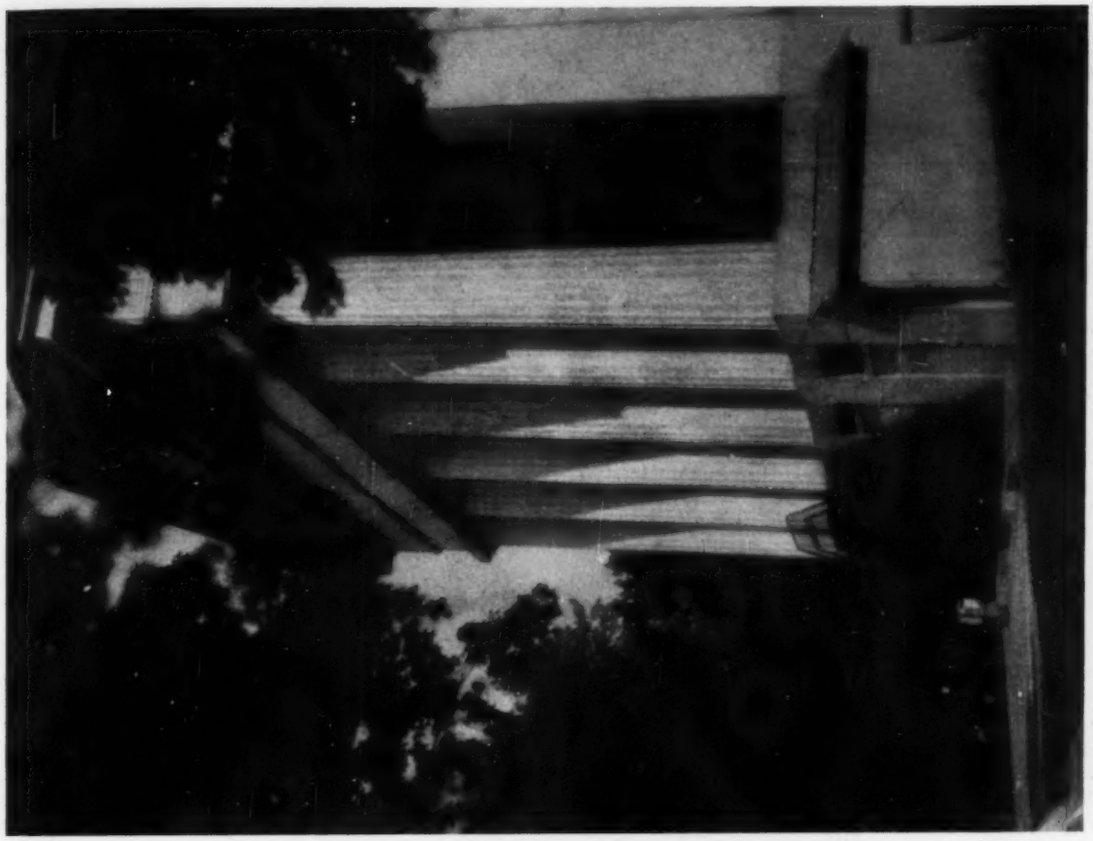
Those who are familiar with American architectural history will remember that Jefferson was ever a champion of the classic, and believed that classic purity lies more nearly in the Roman, and indeed in the Italian Palladian, than in the Georgian forms prevalent in the last decade of the eighteenth century. While in France, as representative of the young republic, he paid considerable attention to the Roman remains in the south of France, particularly the Maison Carree, at Nimes, and championed a design based upon this famous Roman structure as worthy for the capitol of Virginia. He believed the new republic on this side of the Atlantic would do well to look to the classical architecture of the old republic in Italy for suggestions in architectural expression. His own residence, Monticello, which showed distinct Palladian leanings, showed also pronounced Roman tendencies, as did, in a rather more intense way, his later University of Virginia group.

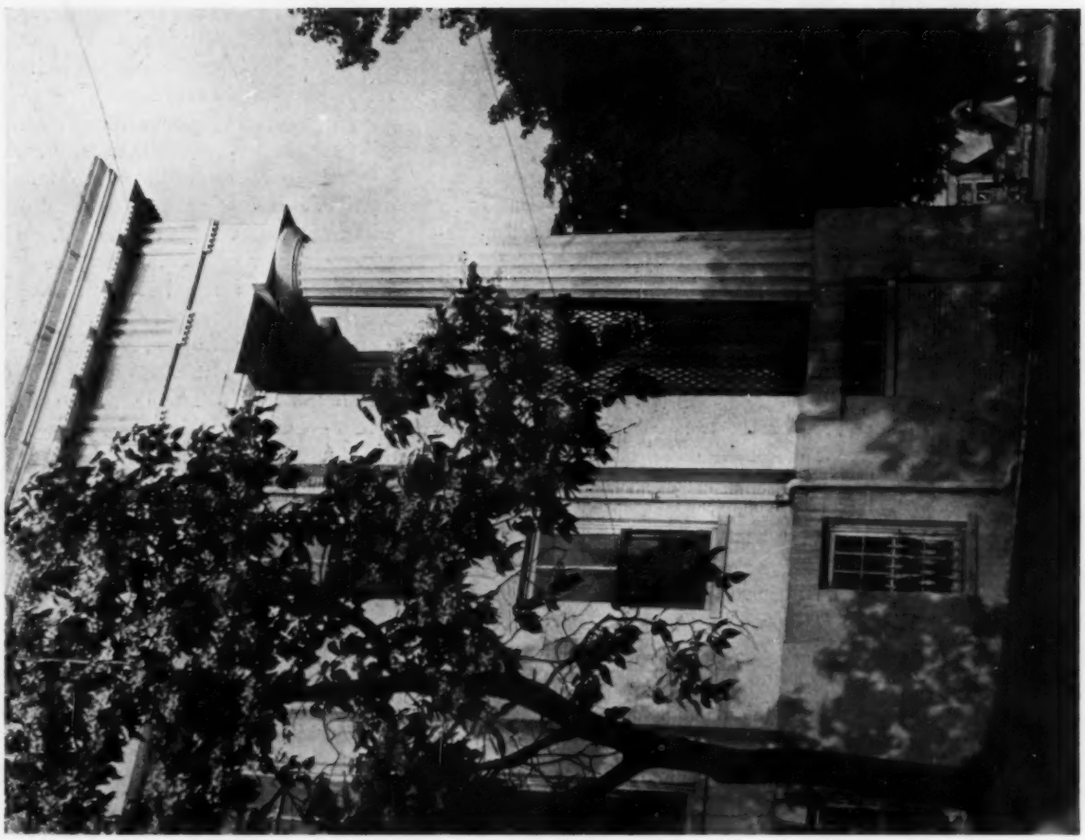
The Roman, or "Classical" Revival, as it is generally termed, arrested the momentum of the Georgian and in this way prepared for the Greek Revival that was presently to be introduced by Henry Benjamin Latrobe, an English architect of distinct abilities, who arrived in America in 1796. Mr. Latrobe, due to the English interest in things Grecian, and through the aid of Stuart and Revett's "Antiquities of Athens," Major's "Pæstum," Chandler's "Ionia," and similar publications, had thoroughly mastered the principles of Athenian architecture, and, so far as I know, was the first American architect to be so equipped. Latrobe's first chance came with the design of the Bank of Pennsylvania, two years after his arrival in America, and this design, which met with almost instant popular acclaim, awoke Americans for the first time to the beauties of Grecian form. This success was followed by other Greek designs by Latrobe and by William Strickland and Robert Mills, both of whom, apparently, embarked upon a Greek Revival program through Latrobe's influence. Strickland entered Latrobe's office at the age of 16, and Mills studied with him while Latrobe was architect of the capitol in Washington. This group of three men, teacher and pupils, were, by their combined influence, to set the vogue for American architecture,—and especially governmental architecture, naturally of great importance, up to 1850.

During the period from 1825 to 1850 many gov-



THE IRON GRILLES, RAILINGS AND STAIRS ARE INTERESTING FEATURES OF THE SOUTH PORTICO OF THE OLD COURT HOUSE AT PAOLI, IND.





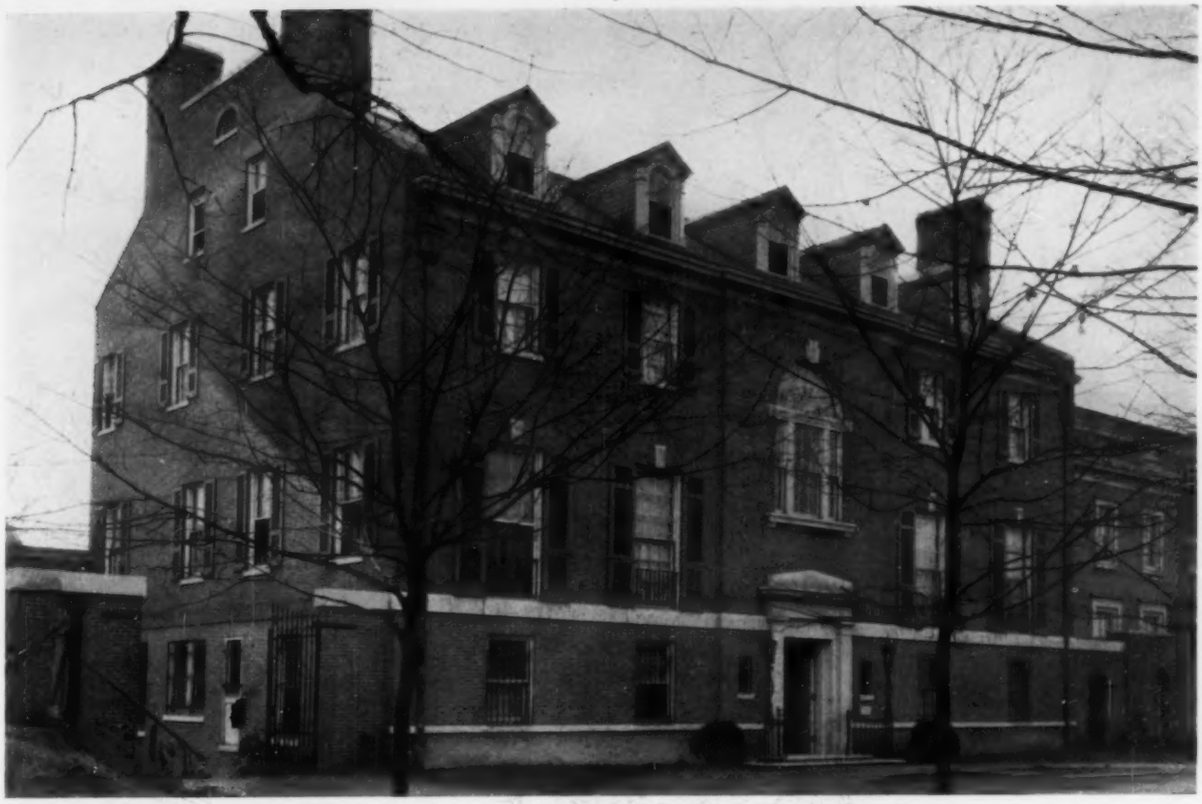
THE GRADUAL SLOPE OF THE PUBLIC SQUARE AT PAOLI, IND., NECESSITATES A HIGH PODIUM AT THE SOUTH END OF THE OLD COURT HOUSE WHICH ADDS MUCH TO THE DIGNITY OF THIS ELEVATION

ernment structures in the way of custom houses, post offices, sub-treasuries and mints, to say nothing of the federal buildings in Washington, followed very closely the Greek temple type. The "official" style of the government keyed the popular taste, with the result that banks, county court houses, churches, residences, and many other types were built in this style. Naturally, the movement filtered westward and into the territory west of the Appalachian mountains, where from 1835 to 1850 many county court houses sought expression in the only vernacular then thought dignified enough for such buildings,—the "Greek manner." This accounts for the existence of the interesting old court house at Paoli, Indiana, some views of which are included here.

Details of the Doric Caps and Columns

The history of the court house of Orange County, Indiana, of which Paoli is the county seat, is characteristic of many another in this section. The story is so typical that I risk giving it in full rather than confining myself to a discussion of the present Greek Revival structure. The first court house was a log building, erected in 1816 at a cost of $25 and used only till such time as a larger and more substantial structure could be erected. Two sessions of court were held pending the completion of a second building, which was finished in November, 1818. In January of 1817 preparations were made to build a "permanent" court house and, as a fund raised by the sale of town lots proved ample, the county board decided to erect a "creditable building." The contract was let to Jonathan Lindley, February 1, 1817, for the erection of a two-storied stone building, 33 x 50, and 14 feet between floors. The court room was to be below, the clerk's office and jury room above. The structure, which was contracted for at $4,000, actually cost $3,950. This is the only court house I ever heard of that cost less than the contract price! The building, which stood at the center of the "public square," is described by a document of the day as being "rather compactly than ornamentally built."

This "seat of justice" apparently satisfactorily fulfilled the needs of this isolated community until 1839, when the county board, after come consideration, prepared specifications for a new court house. The November session of the board annulled the former action, and nothing was done until the autumn of 1847, when the board determined "to erect a new and larger court house on the public square." Specifications were prepared, and a court house committee was appointed. These gentlemen gave a contract to Andrew L. Burke to make the brick, paying $7.50 per 1000 for the ordinary variety and $10 per 1000 for those for the columns. Michael Ombaker was engaged to lay "stone foundations at $1.25 per perch" and to erect brickwork, while William Harman was employed to erect the woodwork. All this labor seems to have been contracted for individually, no such thing as a "general contract" being drawn. Work on the structure was continued until 1850, when it was turned over to the county, fully finished, at a cost of $14,000. The building was considered in its day the handsomest and best built court house in southern Indiana, and was thus described by a contemporary: "The order of architecture, especially the four huge columns of the south end, is nearer the Doric than any other. The shaft of the circular column is of the best brick covered with cement of great durability, while the capital is of plain hydraulic limestone." This limestone, I pause to add, is the far-famed Indiana limestone, quarried most extensively in the country just northward. "On each side and each end of the building," the description continues, "are engaged columns (more properly pilasters) of brickwork relieved by engaged capitals to correspond with the circular columns on the south portico." The distinct slope of the public square necessitates a high podium at the south end of the structure, although at the north end the main floor is only three steps above grade. The building, 53 x 74, is simple in plan. The main floor is bisected longitudinally by a corridor 10 feet wide, with the county officials' rooms either side. The second floor, approached by an iron stairway from the south portico, is devoted to the court room and its appendages. At the center of the ridge is a cupola bearing a clock and weather-vane, a gift of the citizens of Paoli, put up in 1856. If one will examine the accompanying illustrations, I think it will be agreed that, in spite of crudities of detail, the general mass of the structure possesses a distinction surprising for the time, place and method of construction.



STREET FACADE

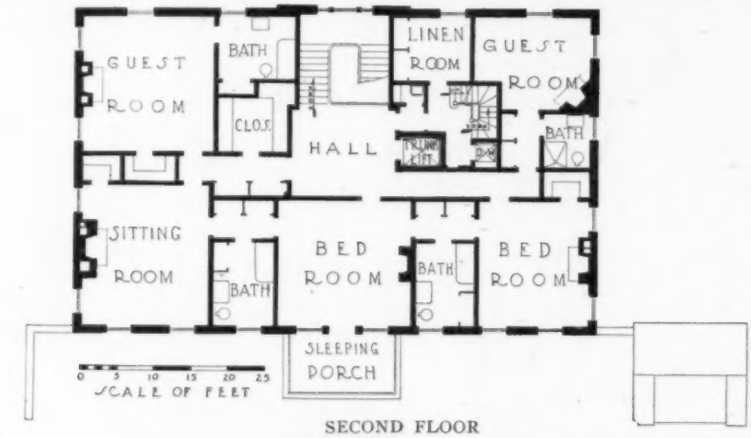
Photos. H. D. Eberlein

GARDEN FACADE

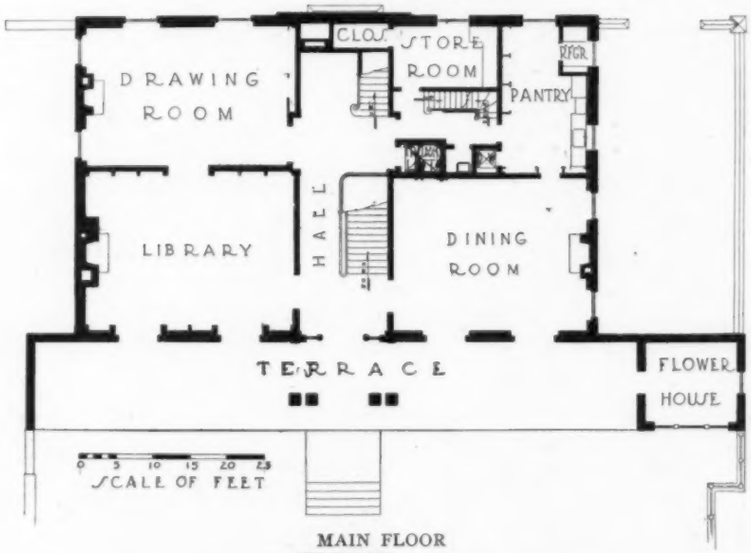
Plans on Back

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT



SECOND FLOOR



MAIN FLOOR

BASEMENT FLOOR

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT

Detail on Back

MAIN ENTRANCE

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT

ELEVATION SECTION

EXTERIOR DETAILS

SCALE
0 1 2 3 4 FT.

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT

FEB. 1928

No. 52

The ARCHITECTURAL FORUM DETAILS

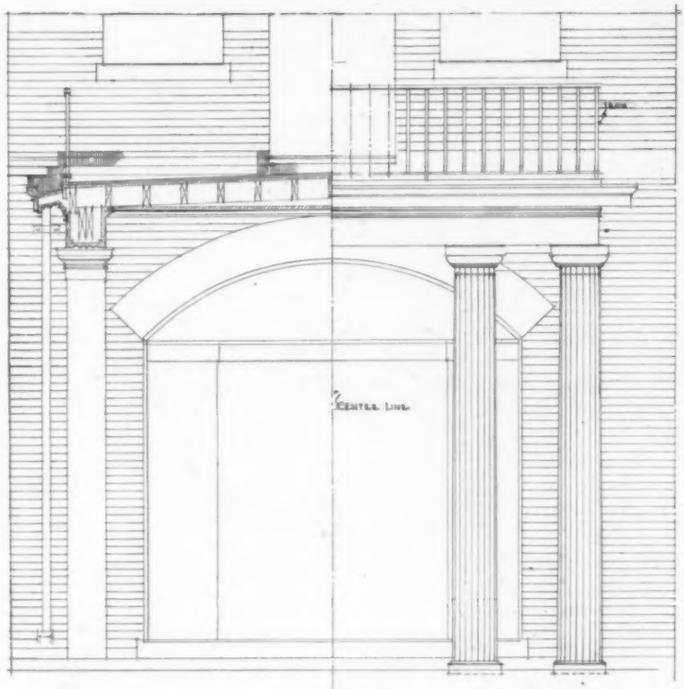
Detail on Back

GARDEN PORCH

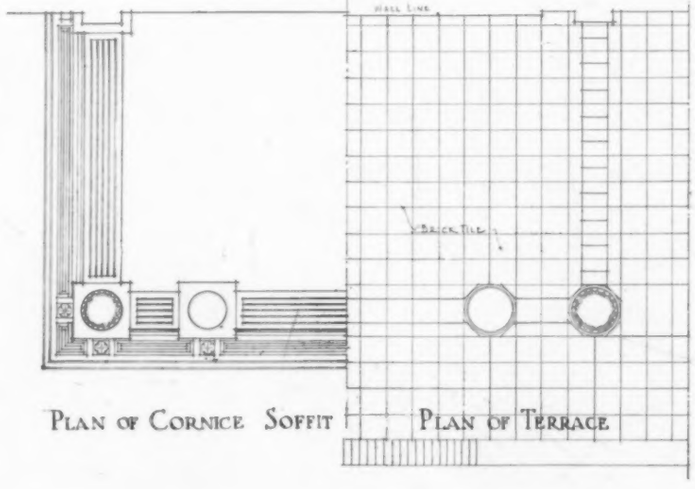
HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT

UNIV. OF MICH.



SECTION ELEVATION



PLAN OF CORNICE SOFFIT PLAN OF TERRACE

SLEEPING PORCH

SCALE
0 1 2 3 4 FT

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT

FEB. 1928

No. 53

ENTRANCE TO MAIN FLOOR FROM GARDEN TERRACE
HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON
PLEASANTS PENNINGTON, ARCHITECT

DETAIL, HALL ON MAIN FLOOR

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT

UNIV. OF MICH.

LIBRARY

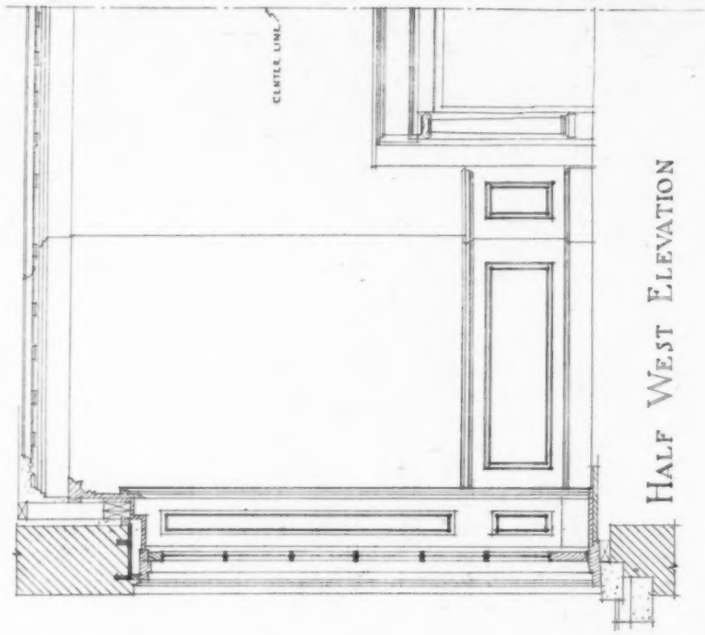
Details on Page 192

DRAWING ROOM

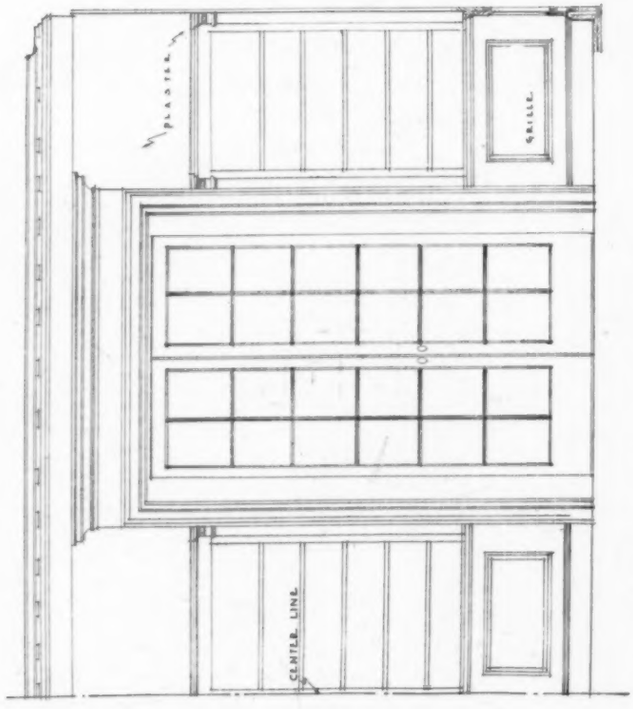
Details on Page 194

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT



HALF WEST ELEVATION



HALF SOUTH ELEVATION

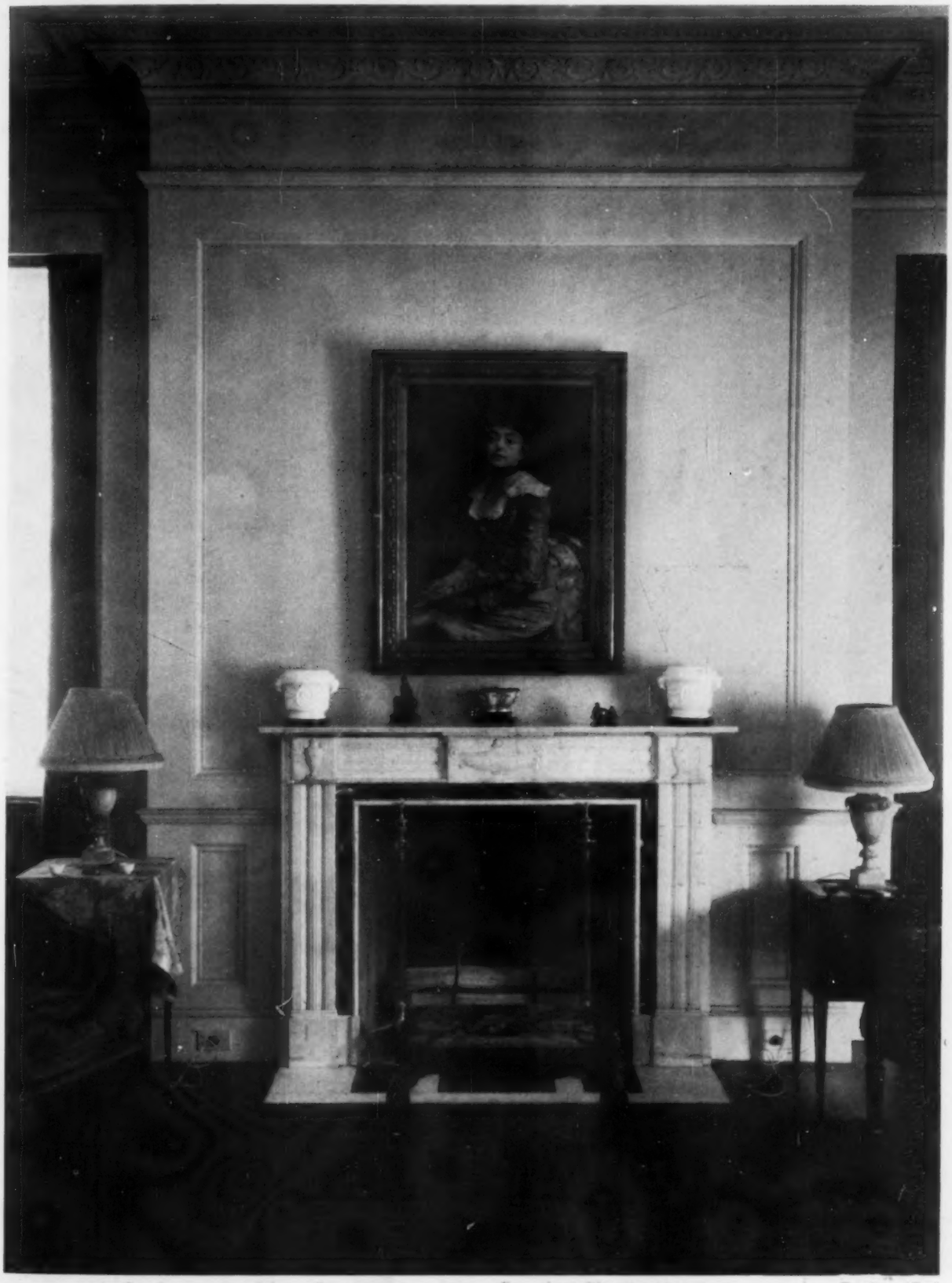
LIBRARY

SCALE
0 1 2 3 4 FT

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON
PLEASANTS PENNINGTON, ARCHITECT

FEB. 1928

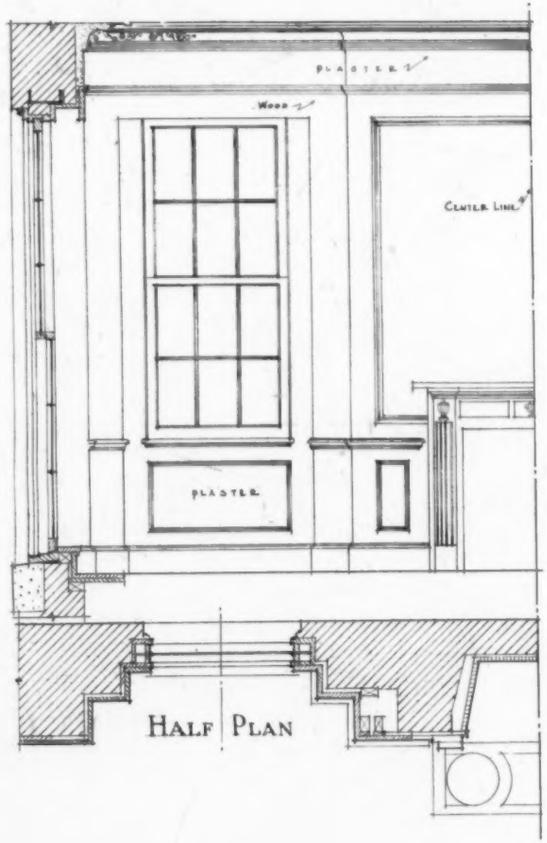
No. 54



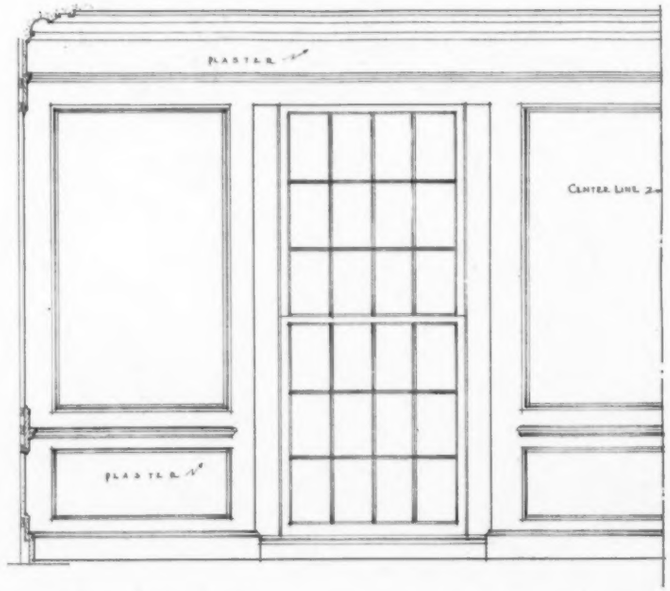
Details on Back

ANTIQUE MARBLE MANTEL IN DRAWING ROOM
HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON
PLEASANTS PENNINGTON, ARCHITECT

FEB. 1928



HALF WEST ELEVATION



HALF NORTH ELEVATION

DRAWING ROOM

SCALE

0 1 2 3 4 FT.

DETAILS, DRAWING ROOM

HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON

PLEASANTS PENNINGTON, ARCHITECT

No. 55

Details on Page 192

OLD BLACK AND GOLD MARBLE MANTEL IN LIBRARY
HOUSE OF ADOLPH C. MILLER, ESQ., WASHINGTON
PLEASANTS PENNINGTON, ARCHITECT

THE ELKS' MEMORIAL, CHICAGO

BY

EGERTON SWARTWOUT, ARCHITECT

ERECTED in the year nineteen hundred twenty-four by the Benevolent and Protective Order of Elks of the United States of America in honor of its members who served in the World War." Thus the inscription on the frieze. I reproduce it because it tells in a few well chosen words just what this building is and why it is, and because it answers questions I am asked repeatedly. The casual, but apparently interested, observer asks if this is an Elks' Temple or an Elks' Club, and whether it was built by Chicago and, if not, why in Chicago. And I answer wearily that, as far as I know, there is no such thing as an Elks' Temple, and that I believe the correct name is not club, but lodge; and anyway this building isn't a lodge, it's a memorial; and that Chicago had no more to do with it than Seattle or Concord, Mass.; that it is a national memorial, and that it had to be built somewhere, and they happened to put it in Chicago; more or less in the center of the country, I suppose, but that it might just as well have been in Washington; and that I myself, for certain selfish reasons, would have preferred New York.

And, now that everybody knows when and why and where it's built, it only remains for me to say that it is on the corner of Lake Shore Drive and Diversey Parkway, at the north end of Lincoln Park, in what was, a few years ago, a good residential district. But now the apartment hotel menace is coming up that way, and I suppose it will soon be hemmed in with Bellevues and Elkviews, all with staring rows of windows and blinking electric signs. However, it does face directly on Lincoln Park and has a fine view of the lake, and the park officials have now been obliging enough to cut several vistas through the trees so that there are some interesting distant views of it. The plot it stands on is of fair size, about 400 x 250,—not as large as it should be, by a long shot, but good sized for a large city.

The inception of the memorial was, I believe, in the committee that handled the hospital relief and war work of the order, but my own first knowledge of it came in the spring of 1922, when I received an invitation to take part in a limited competition under a program written by their professional adviser, the late Col. J. Hollis Wells. It was a good program, and the idea was architecturally interesting, but I hesitated a bit, as I wasn't then a member of the order, and I had a perhaps natural, but as it proved totally erroneous, idea that the winner of the competition would perforce be a good Elk. As a matter of fact, I question whether any of the invited architects were, but I do know that in the award of subsequent contracts to builders, sculptors and artists, there was never a question of such a restriction. The building commission, a rather large one, was one of the most, perhaps the most, far-seeing and enlightened commission with which I have ever had the

The Elks' Memorial, Chicago
Egerton, Swartwout, Architect

pleasure of collaborating; while it didn't throw money away, it demanded the best, and was willing to pay a fair price for it; it realized it was building not a commercial structure but a memorial to its heroes; it played no favorites; it got the best materials, the best builders and the best artists the country afforded,—Blashfield, Savage, Fraser, Weinman, Laura Gardin Fraser,—as fine a lot as were ever associated on one operation.

As to the building itself, the central feature is, of course, the memorial; in the wings are the offices of the *Elks' Magazine* and the grand secretary. In other words, it is not only a memorial but a useful structure, a national headquarters. But this utilitarian side of it is so submerged in the memorial proper that the offices become a mere background as it were. The main feature is the great circular memorial hall, which is truthfully expressed on the exterior. The dome is a real masonry dome, and so is the interior shell, of Guastavino tile, with coffers directly applied to it. The whole building is, I'm glad to say, thoroughly logical in construction; there is no fake about it; it is simple, heavy masonry. People have asked me why I did a circle. I can only say, as I believe I've said before, why not? And yet perhaps there is a reason,—no ritualistic reason, no precedent of the order, but rather a common sense reason, and that is that I wanted to do something, and I thought the commission wanted to do something, that would come to be regarded as typical of the order. The Masons have for some reason or other, perhaps occult, perhaps casual, I don't know, preëmpted the square, with a colonnade generally on a basement, and stepped dome or roof,—all very fine and very monumental, and following somewhat the impetus given by the unknown architect of King Mausolaus who possibly was a Mason himself. Therefore a square was out of the question; the circle had never been used, that is, exactly as it is here; it makes a good practical shape, easy to dome; and it is distinctive, and in time will become, I hope, associated with the order. The next man who does a memorial for the Odd Fellows or the Moose or some other one will be hard put to it to get a distinctive shape. It's rather a stimulating thought. A triangle has been tried in the French projects of 1800, but it's not easy; an octagon would be good, but a hex is loathsome; and there might be some African symbol distinctly appropriate to the somewhat mythical Sons and Daughters of I Will Arise.

These are pleasant thoughts, but I must return to the building, or I will exceed the space allotted, and possibly crowd out some of the really beautiful illustrations. I was speaking of the central feature being round. It is really quite a large round, about 105 feet in diameter, large enough for the sweep of it to be very impressive, seen in perspective from below. The feature of the exterior is, or rather will be, the great sculptured frieze under the columns; this is about 5 feet high and is now being carved from the models of my good friend, A. A. Weinman, and is now about 15 per cent finished. It is a heroic thing, nearly 165 feet long and beautifully composed and modeled. There are few, if any, sculptors who can equal Weinman in architectural sculpture, and few who could model a richly figured frieze on a round surface and keep all one plane. The theme of the frieze is too complicated to explain here; generally it represents the Horrors of War and the Glories of Peace. A particular feature of the arrangement is the great seated figure on each side of the entrance door,—figures much larger in scale than those of the frieze, and yet in perfect harmony with them. I'm sure this frieze will be, when complete, one of the outstanding pieces of architectural sculpture in this country, or in the world. Weinman is also modeling two bronze heroic groups for the niches in the ends of the wings. These are as yet in the scale model stage, but enough has been done to show that they will have the same feeling of strength and grandeur as his frieze.

Upper Stair Hall, Elks' Memorial, Chicago
Egerton Swartwout, Architect

In front of the building and on stone pedestals at each side of the steps at the sidewalk are two large bronze reclining elks by Laura Gardin Fraser. Now a standing elk is not a very monumental animal. His head is fine, but the legs are too slender for the heavy body. You would have to stand him in the grass or put a lot of other elks around him to get a

solid effect; but the reclining elk has a very fine silhouette, and Mrs. Fraser has made the most of her opportunity. These elks are now cast and in place and are, I think, the best examples of animal sculpture in the country. Under the colonnade, between the columns, are 24 panels nearly 5 feet square, and for these Gerome Brush has made a series of excellent models which will soon be carved. They are similar in treatment to Weinman's frieze below them, and are well composed and executed.

I haven't said much about the architecture of the exterior. It's much easier to talk about some other fellow's stuff, which is really good, so I'll only say it is most excellently built of blue limestone, or gray as they now call it, and is,—well,—not weak. There is a really interesting feature in the two open courts. These courts are formed by the projecting office wings and the reception rooms at the back, and there is a sort of loggia in front, which is glass-enclosed and forms a corridor connecting the wings with the memorial hall. The walls of these courts are low, and there is a good deal of direct sunlight in them, and they are quite heavily planted with shrubs and ivy and really good-sized trees which can be seen through the loggia and which echo the planting in front and on the upper terrace.

Stair Hall, Elks' Memorial, Chicago
Egerton Swartwout, Architect

As I have said, the feature of the building is the memorial hall. This is circular, about 67 feet across and nearly 100 feet high, and is entirely of marble up to the column caps, some 50 or 60 feet above the pavement,—and very beautiful marble it is, too. The basic marble, the wall marble, is Eastman cream, some almost clear, some veined with golden brown and with green, and some with a pinkish and some with a bluish cloud. I didn't want to use a staring white, and I didn't want to use the rather drab yellowish buff of the self-toned foreign marbles. I had used Eastman in rather small quantities in the Denver Post Office, and I felt it was just the thing we wanted, but it seemed questionable whether the quarry could supply the 10,000 odd feet that were required. I can say truthfully we scoured the entire world for cream marble, but there wasn't any. In my opinion there is no marble that compares to Eastman, so finally the commission agreed to its use, and we got the amount we wanted; and it's all thick stock, too; 3-inch ashlar, with foot heads and a lot of heavy work in the cornices and vaults and domes of the encircling corridors and lobbies. The columns of the lower order, under the impost, are varied; four of each for the coupled columns supporting the main wall, and of colors that do not cut out too much from the cream marble of the wall,—*Breche Violette, Escalette, Pavonazzo, Fleur de Peche, Skyros, Breche Centelli, Fantastico Viola, Madre* veined Alabama and Eastman *Cippolin* and some others. The frieze of this order is *Lumi*, a light red marble with small white veins. It shows in the illustrations much darker than it really is, as also, I regret, do the bronze register faces, which are really bright golden bronze. The wreaths in the frieze are of Eastman stuck to the *Lumi*. The columns of the niches are in pairs, of *Levanto, Verte Maurin, Rouge Rubo* and *Rouge Jaspe*, very rich and deep in color, and over the niche heads the *Lumi* frieze changes to *Rubo* to tie the columns together. There will be four heroic gold bronze statues in these niches. James Fraser has them now nearly finished, and they will be, I'm sure, the very best things he has ever done, and that means much; the best things of James Earl Fraser equal the best anyone can do.

The columns of the main order are about 25 feet high in the shaft and are of heavy, rich colored marble. Here again the marble varies, but only in the color; the tone value is the same. I doubt if the casual visitor would notice they were different unless it were called to his attention. They are really beautiful examples of *Verde Antico, Tinos, Rouge Jaspe, Levanto, Rouge Rubo, Rouge de Ranca, Verte Maurin*, three or four of each, not placed together, of course, but scattered. The dome, as I have said, is plaster on Guastavino tile, richly decorated by Charles Rinschede, and the whole space is lit by reflection from the eye of the dome. I worked out this scheme some years ago for a large dome in Boston, but it was never carried out, and I had quite a time persuading the lighting experts of the Elks'

Memorial that it would work. The reflector is of plaster on wire lath in the shape of a hyperbola of revolution, with the apex rounded, which by the way is not necessary, and which gives the curious effect of a golden ball hanging in space some distance above the aperture of the dome, whereas in reality it is something like 8 feet below the aperture. The plaster of the reflector is covered with gold, silver and copper leaf in a conventional design of rays and clouds, and it receives and reflects the light of 50 or more low-power searchlights, or rather powerful reflectors, concealed in the space between the inner shell and the outer dome. The light is controlled by dimmers, and the effect is really fine; the light does not touch the side walls but is reflected up from the floor; the dome itself is in obscurity, and the effect is exactly as if there were a brilliant sun overhead shining down through a golden skylight. By turning on the light full power, small print can be easily read on the floor, 100 feet below. When the light is off in the daytime, the reflector looks merely like a piece of decoration. It is a good stunt, and as far as I know a new idea.

But the real glory of the memorial hall is its decoration. We persuaded Blashfield to do three large decorations in the lobby leading into the grand reception room, each about 8 x 16. These are now in place, but unfortunately don't show in the illustrations. They are fine, all of them, and the one over the door is, I think, the best thing the dean of mural painters has ever done. He may do even better, for he is yet a young man, but the Elks are indeed fortunate in possessing the best work of the best known and best loved mural painter in America. The large panels, 12 of them, between the windows and back of the marble columns, are now in place and are the work of Eugene Savage. I won't attempt to describe them; it's been done so much better than I could by Royal Cortissoz in *Scribner's* of July last. I'll only say they are wonderful. Savage is now doing the eight kite-shaped panels above the niches, a proposition really much more difficult in design than the panels above. At the time of writing, in November, 1927, the quarter-size working sketches had been approved, and the panels should be in place in the spring or early summer. Savage has also a number of paintings in the grand reception room, two large wall panels, and a whole lot of ceiling paintings of various sizes. I counted up to 68 one day,—maybe there are more. This room, which is shown in an illustration, is about 75 feet long and 30 wide and high,—about a double cube. The walls are English oak and the ceiling gilded. Savage has as yet only sketches. Here the decorations will be much heavier and deeper than his work in the memorial hall; they have to be, to stay on the same plane as the heavy oak and the rich, deep gold, but I'm sure the effect will be equally fine. In this room are five very excellent windows in stained and leaded glass by Paris & Wiley,—very good in design and subdued in color,—and Charles Kinsman has done some good fixtures.

I haven't space to go into any more details, and really it isn't necessary. I can only express my great appreciation of the collaboration of those who contributed so much to the building,—to ex-Governor Tener, and the Hon. J. T. Fanning and the rest of the commission; to my old friend, the late Col. Wells; to George Smith, our representative at the building; to John Hegeman, the builder, and his associates, Fay Evans and Andrew Leith; to my assistant and my friend, E. A. Bauer, known as "Eddy," without whom I would have been swamped in the details of construction, and who knows as much about building as he did about baseball when he pitched for Pittsburgh,—and to all the artists who have done their bit. There has been a good deal said lately of collaboration by Grant LaFarge and others at conventions and dinners. Some day I hope Grant will learn of this building and talk about it, for here as never before, I believe, is an example of real collaboration.

Side View, Elks' Memorial, Chicago
Egerton Swartwout, Architect

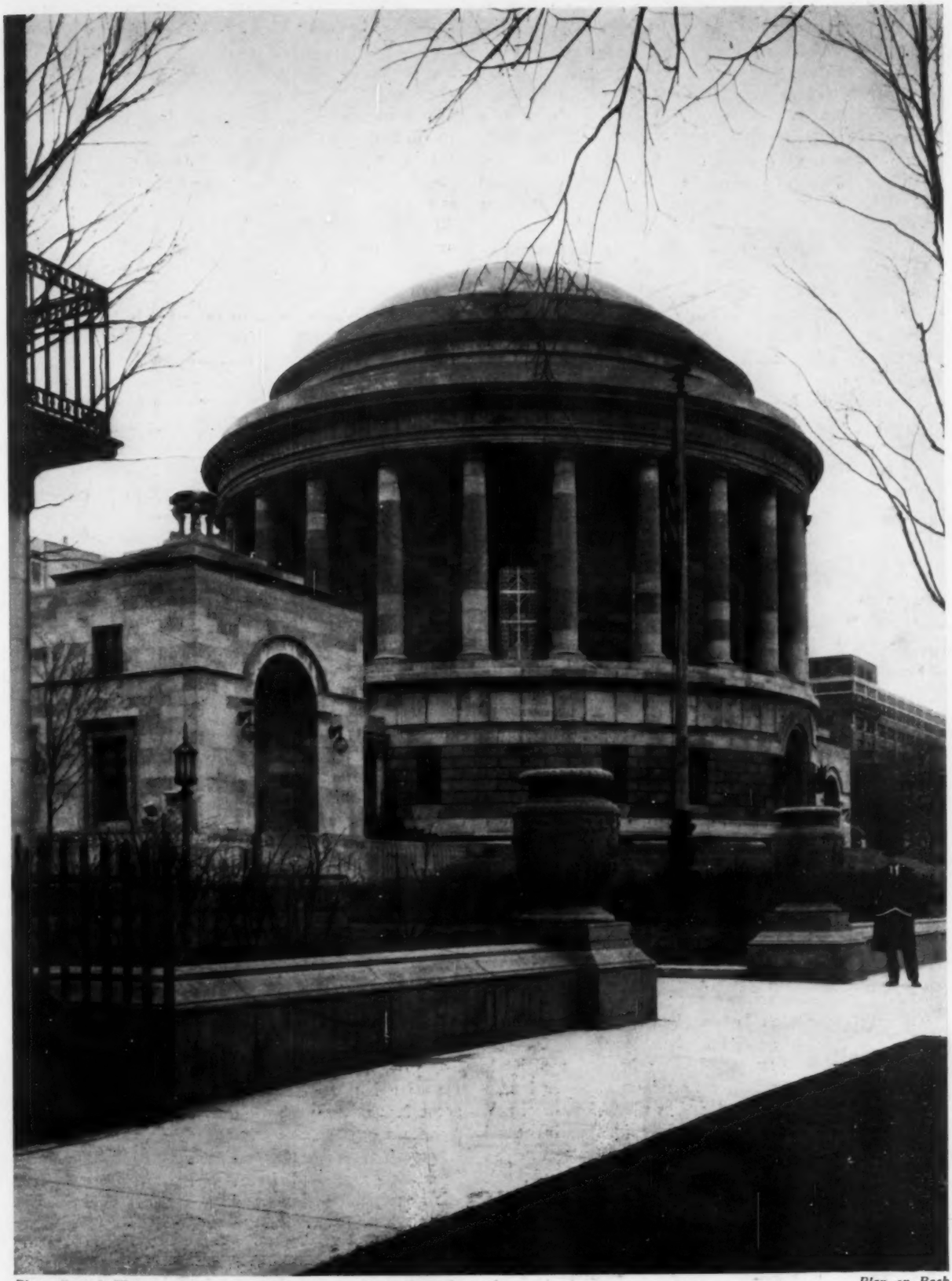
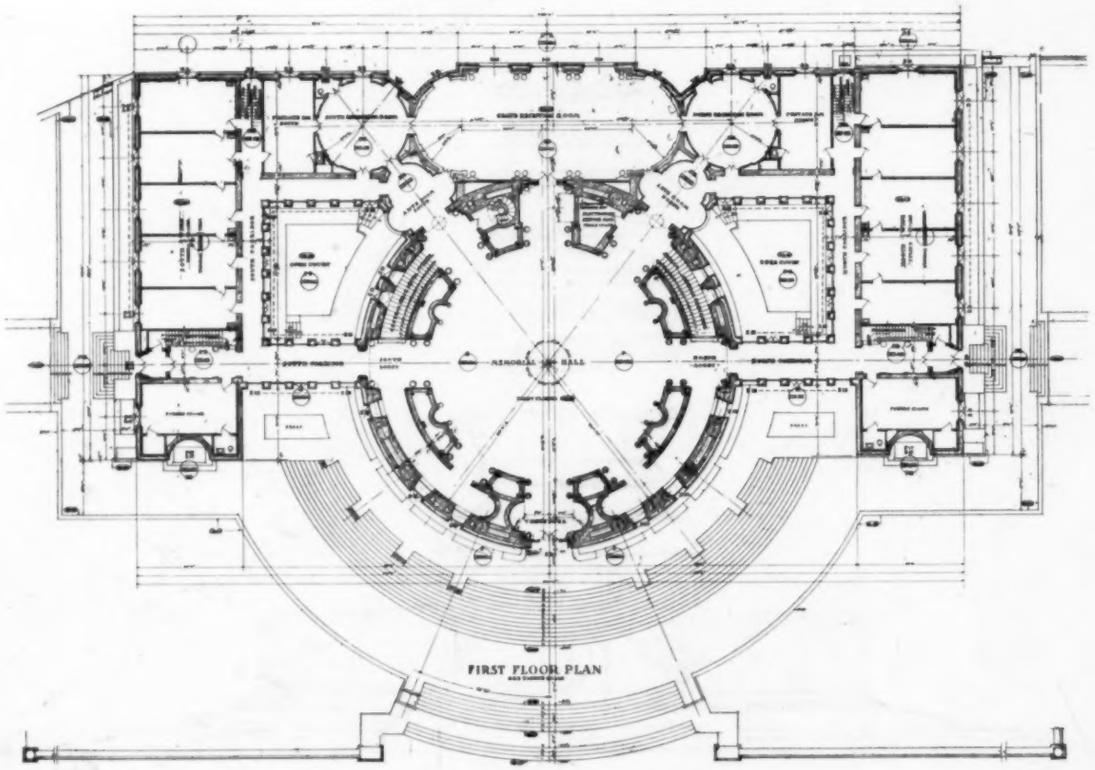


Photo. Paul J. Weber

Plan on Back

THE ELKS' MEMORIAL, CHICAGO

EGERTON SWARTWOUT, ARCHITECT

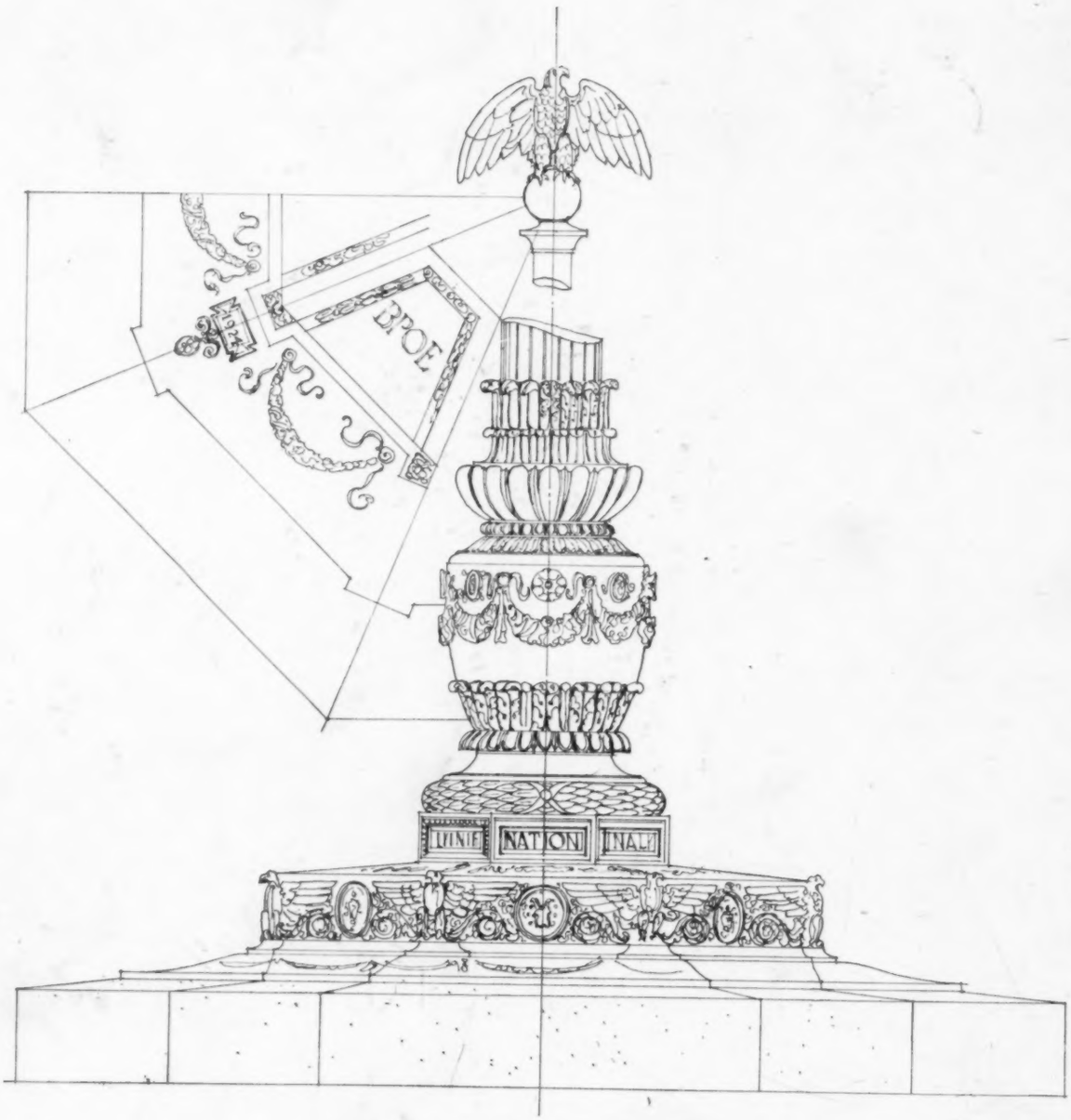


THE ELKS' MEMORIAL, CHICAGO

EGERTON SWARTWOUT, ARCHITECT

Photo. Trowbridge *Detail on Back*

BASE OF FLAGPOLE
THE ELKS' MEMORIAL, CHICAGO
EGERTON SWARTWOUT, ARCHITECT



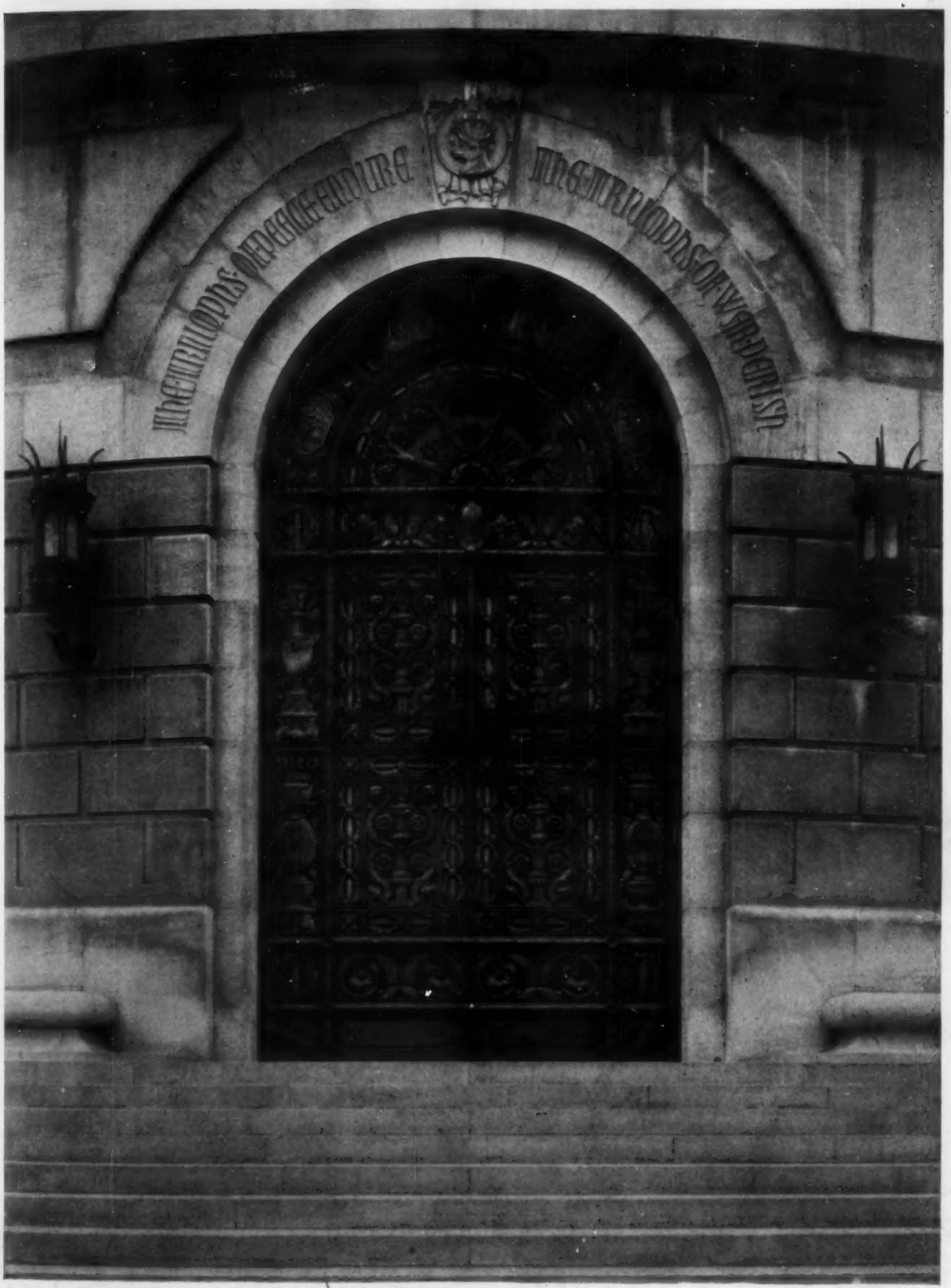
FLAG POLE BASE
ELKS MEMORIAL

SCALE
0 1 FT.

FEB. 1928

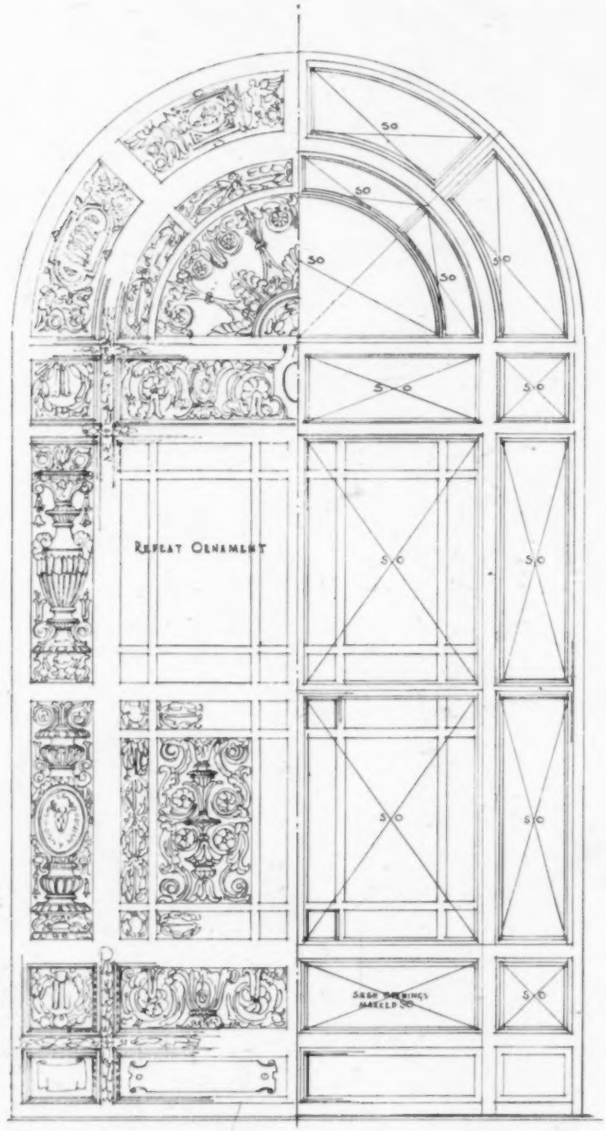
NO. 56

The Architectural Forum Details



Detail on Back

BRONZE ENTRANCE DOORS
THE ELKS' MEMORIAL, CHICAGO
EGERTON SWARTWOUT, ARCHITECT



HALF EXTERIOR HALF INTERIOR

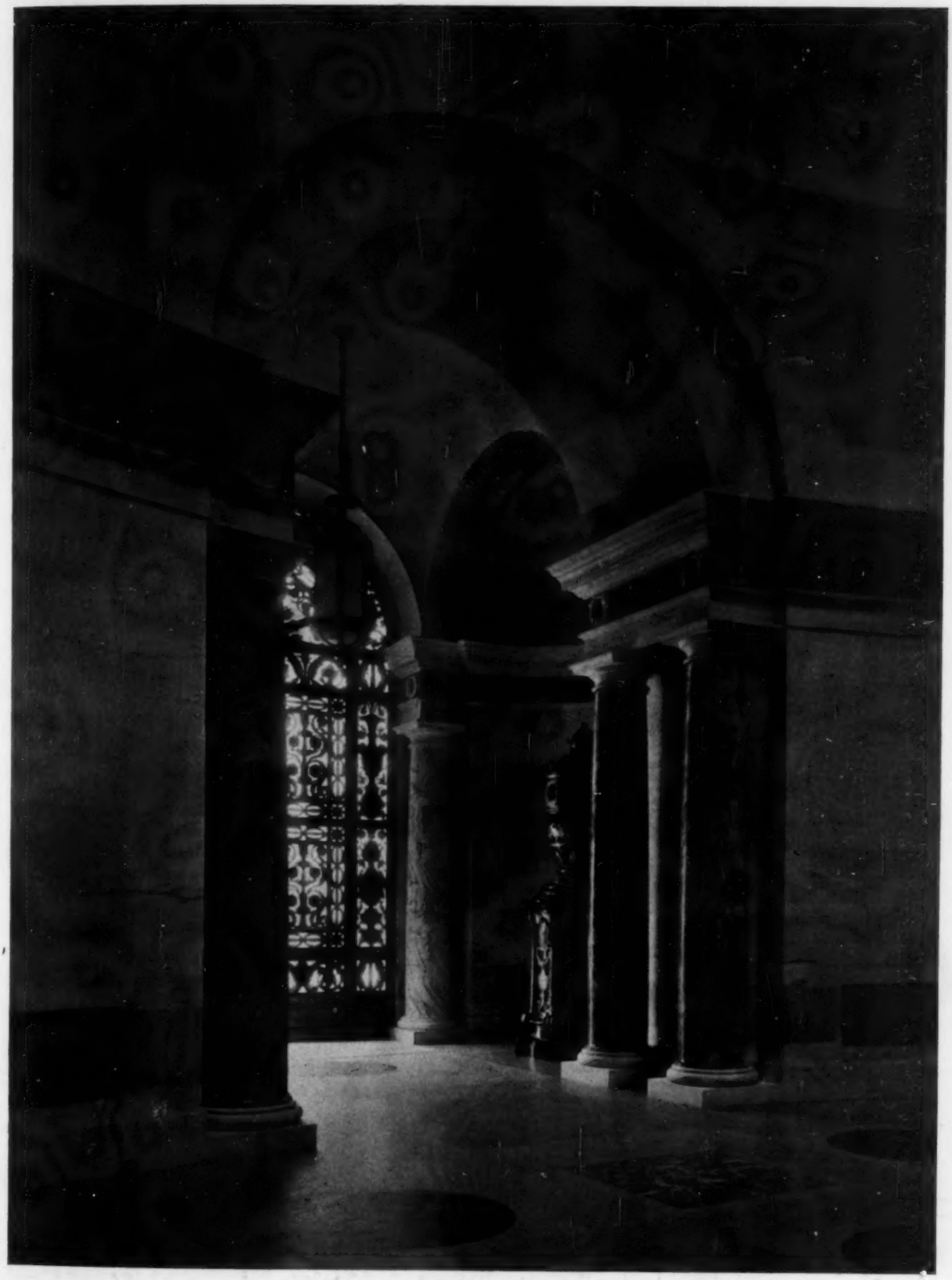
3/4" SCALE DETAILS OF ENTRANCE DOOR
ELKS MEMORIAL

SCALE
0 1 2 3 FT

FEB. 1928

No. 57

The Architectural Forum Details

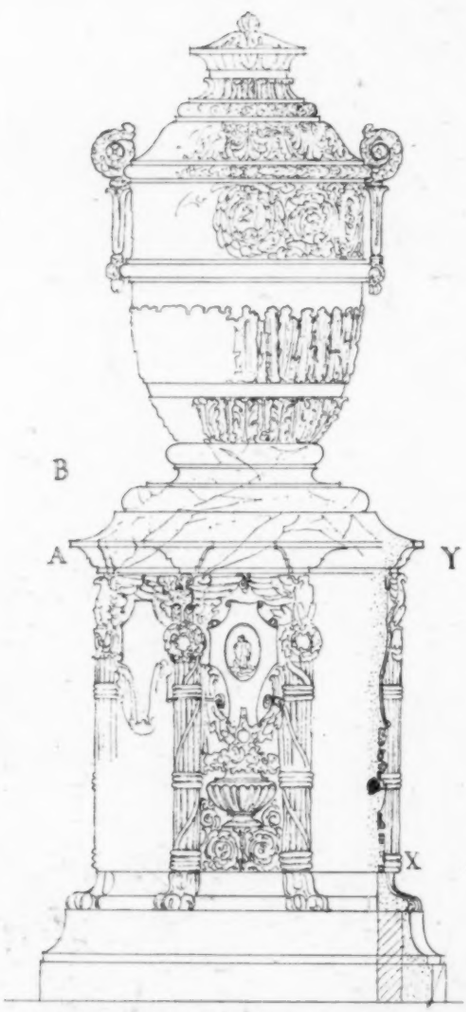


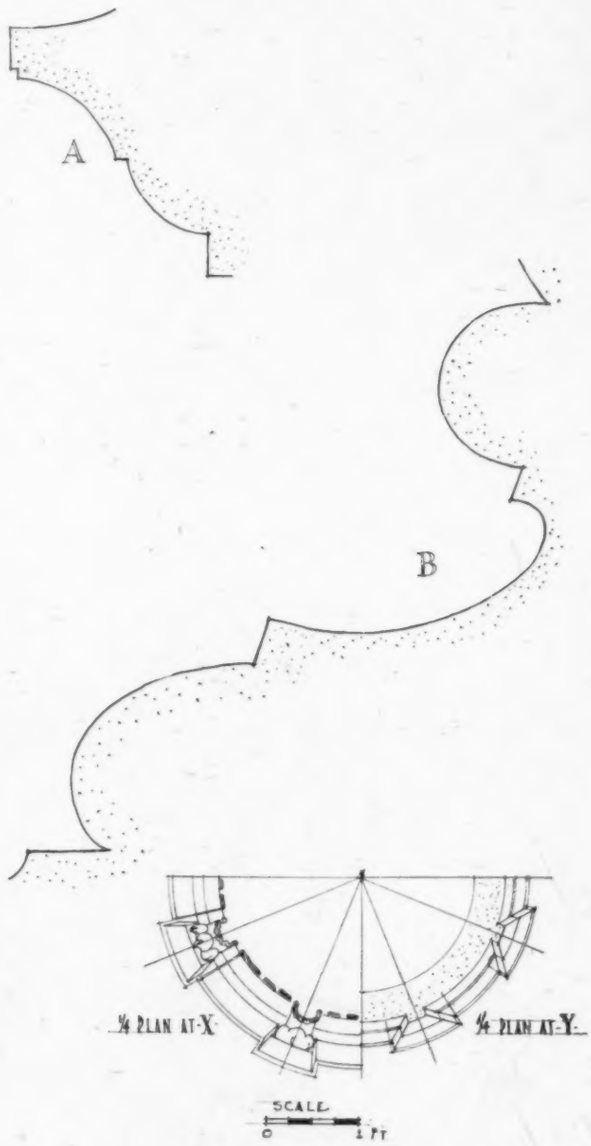
MAIN ENTRANCE
THE ELKS' MEMORIAL, CHICAGO
EGERTON SWARTWOUT, ARCHITECT

UNIV. OF ILL.

Detail on Back

BRONZE RADIATOR ENCLOSURE
THE ELKS' MEMORIAL, CHICAGO
EGERTON SWARTWOUT, ARCHITECT



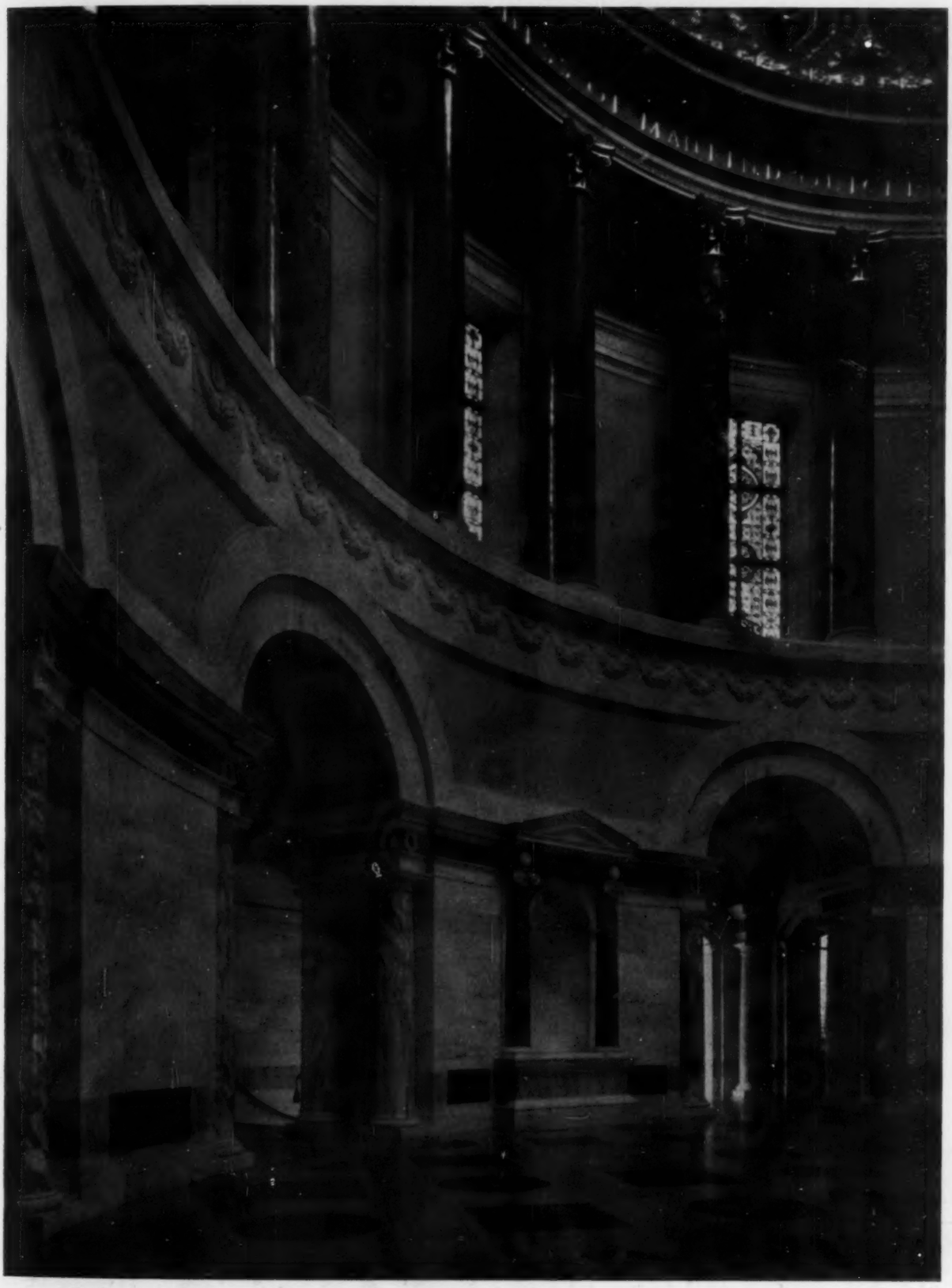


BRONZE RADIATOR ENCLOSVRE
ELKS MEMORIAL

FEB. 1928

No. 58

The Architectural Forum Details



MEMORIAL HALL
THE ELKS' MEMORIAL, CHICAGO
EGERTON SWARTWOUT, ARCHITECT

GRAND RECEPTION ROOM
THE ELKS' MEMORIAL, CHICAGO
EGERTON SWARTWOUT, ARCHITECT

UNIV. OF MICH.

WINDOWS IN GRAND RECEPTION ROOM

NORTH RECEPTION ROOM

THE ELKS' MEMORIAL, CHICAGO

EGERTON SWARTWOUT, ARCHITECT

GUANAJUATO, THE MOST MEXICAN CITY

TEXT AND SKETCHES BY
WILLIAM P. SPRATLING

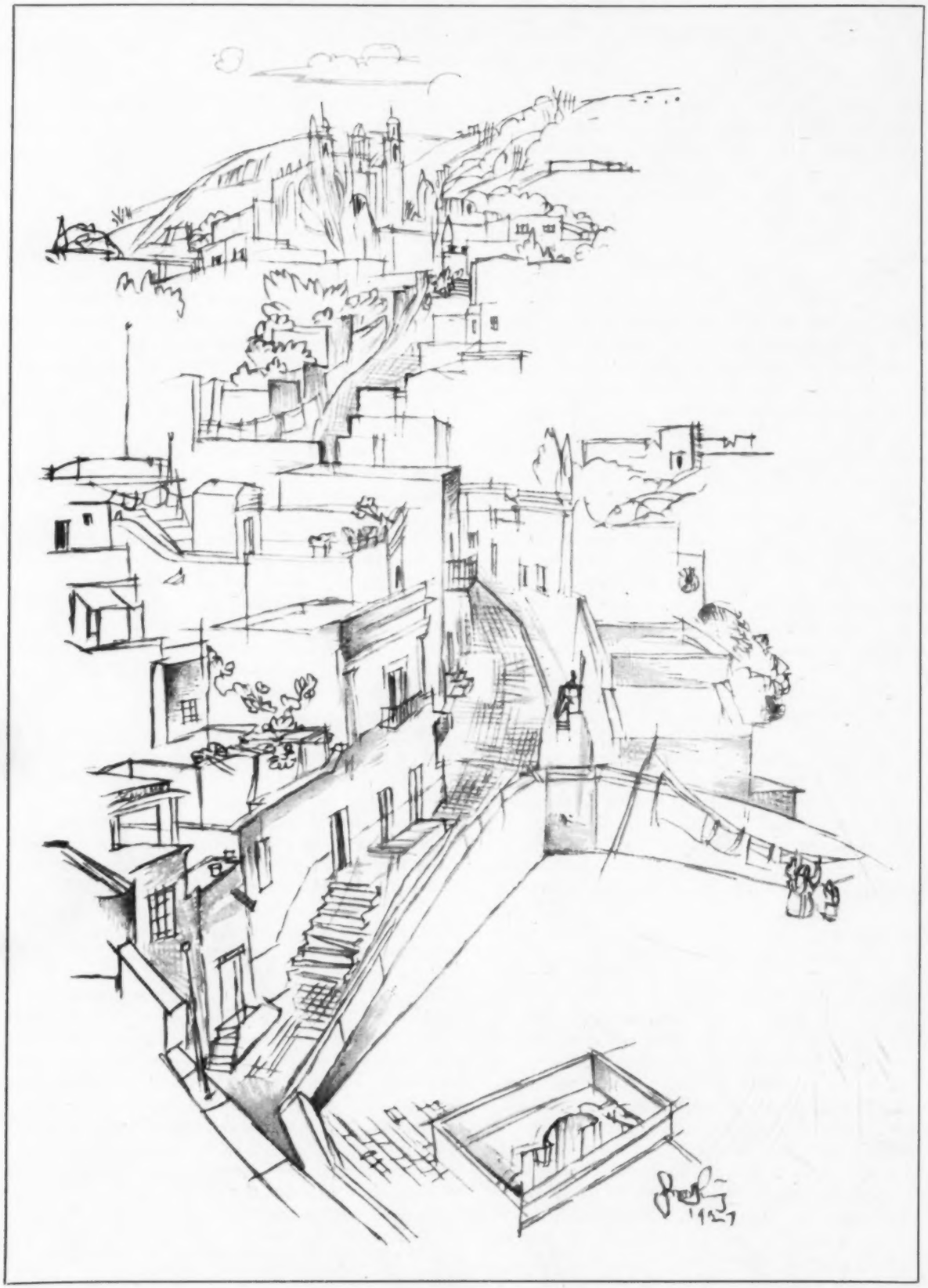
GUANAJUATO, a day's ride from Mexico, is there to be discovered, like a vein of rich gold ore, squeezed into a pocket between great mountains which protect and supply. Looking down into the rugged valley, the accumulation of beautiful old buildings with glazed domes and towers actually takes on the appearance of so many bright minerals,—grains of fine things that have been washed and precipitated downward into the folds of these jagged hills. Architecturally, dismantled and set up again, Guanajuato should equip ten cities with enough beautiful buildings, balconies and streets to equal New Orleans or San Francisco, which we like to call America's most interesting cities. If one of her monumental hills were added to the balance,—the kind of hills that are studded with pink and blue adobe houses,—and the summit armed with regiments of organ cactus, the result would surpass any Italian Fiesole for precipitous and surprising beauty. Not that I should like to see this place dismantled in any detail,—the allusion came in connection with a remark from one of the editors of a newspaper in Mexico who, knowing that I planned on visiting Guanajuato, remarked with conviction that there I would find Mexico's most interesting city and one very like my own New Orleans,—balconies and all. He meant, of course, that it is really Mexico's most beautiful city, which, beyond any doubt it must be.

Since Guanajuato has the further advantage of three dimensions instead of New Orleans' geographical two, as an artist I found it a constant strain not to miss some angle of the scene, everything being constantly different and of absorbing interest,—including the vertical. Furthermore, there was not the slightest danger, I discovered almost immediately, of going in a wrong direction toward dull or uninteresting territory. The plan for Guanajuato would probably reveal no squares at all, or anything that might be called "blocks." It seems to be an arrangement of triangles and hexagons instead,—never with two sides equal,—frequently with curves and, counting the almost vertical hills, sometimes spherical. Therefore, as there is no one continuous direction, the absence of street names does not cause trouble. It is a very pleasant and "intriguing" arrangement.

With the exception, perhaps, of the pretentious and grandiose *Teatro Juarez,* with a sort of Baptist church effect, and the vast city market (apparently designed after the *Petit Palais*), there is nothing extraneous about this architecturally unique city. Harmony like this is almost impossible in our United States, where building codes, materials of construction and a moving scale of building costs undergo perpetual change. Guanajuato today is still in perfect accord with the traditions of her early Spanish Colonial period,—and has been for the past four centuries. Even use of such a logical innovation as reinforced concrete has had little effect over the simple and beautiful forms of stone construction which are universal there. It is a city of stone, adobe, and enameled tile,—not of brick and pretentious marble. The unusual variety of simple stone texture becomes, for the architect, something worth noting in itself,—white stones and pink stones and a beautiful banded green,—so delicate in its beautiful lined tints that I found myself examining one or two columns merely to see if they were not painted! The adobe, of course, is, in the more elegant streets, stuccoed and colored. Guanajuato has more color,—more paintable color,—than any city in Mexico. Naturally, our discreetly gray cities of the north would not bear mentioning in comparison. Pinks succeed greens, and pale yellow buildings may have corners banded in a sienna red. The walls of blue when in shadow match the sky above. A turn in a winding, cobbled passageway may reveal all these colors and more, and with a single shaft of sunlight the tunnel-like alleyways become as luminous and as full of pure color as a painting by Sorolla.

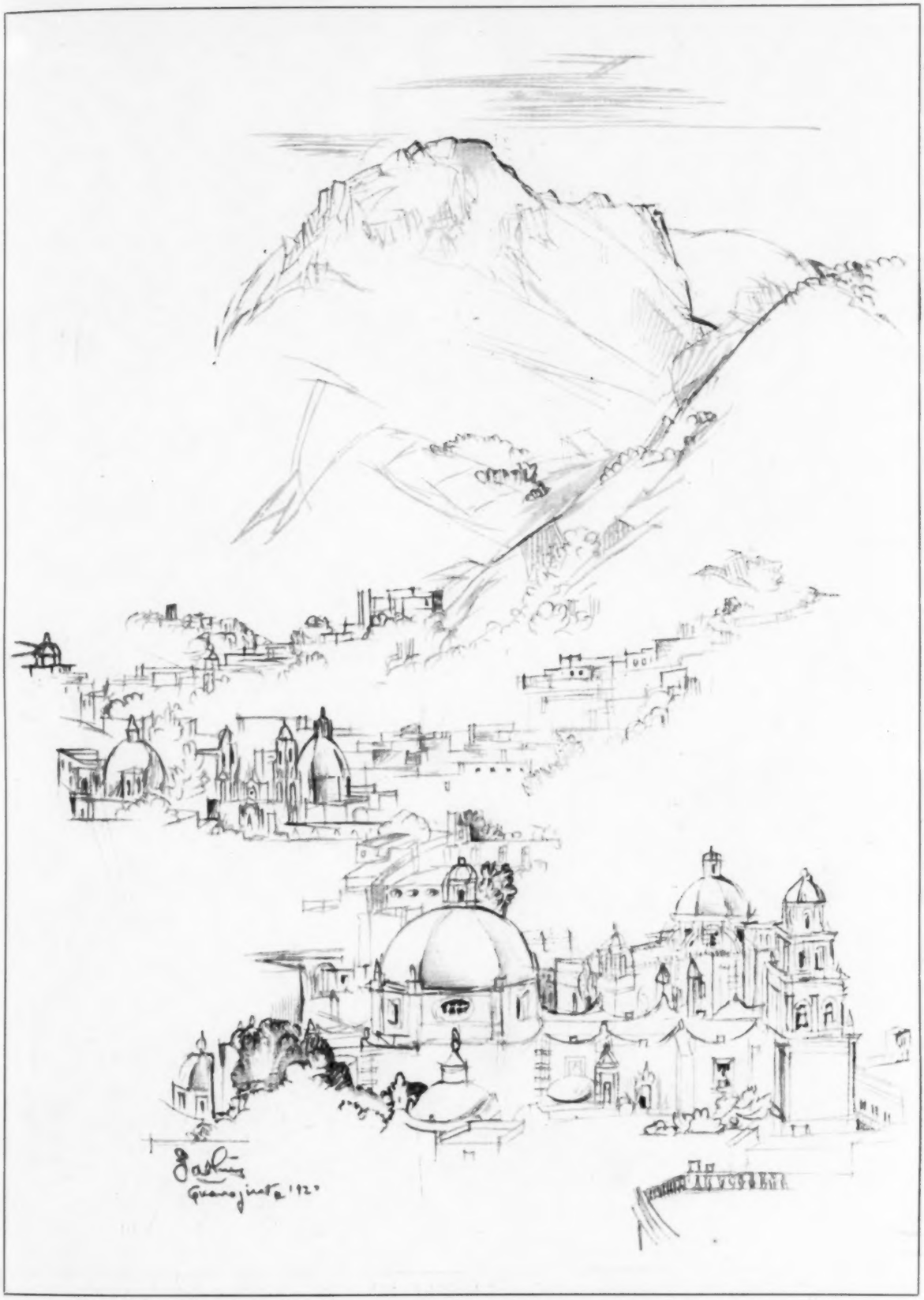
The city seemed to have that casual, rather intimate quality that one associates with an older, more European, civilization; as an example of this casual quality, my hotel had the advantage of nine doors opening onto the street. All nine were identical,—quite simple openings in the continuous green walls of the facade. Entering, one could discover either a lobby, a billiard hall, a very ancient saloon, a restaurant or another lobby. There being no indication or painted signs, for the stranger it became a sort of game as to how to make a choice. It took me two days to work out the scheme of direct entrance. Doubtless the older inhabitants possessed a certain advantage. In this particular hotel one could have an airy, spacious room, with tile floor (comfortable modern bed), overlooking the little triangular *jardin,* with three very complete meals per day, all for one-half the price of an interior room on the sixth floor of the sadly Americanized, plate-glass-fronted hotel such as I found in the proud city of Guadalajara.

The cemetery in Guanajuato, as one can diagnose with sufficient satisfaction from colored post cards, is a show place, but not beautiful. Incidentally, there is a splendid view of the city far below from the terrace. Within the cemetery's building there is a patio from which one is led into another world, lying only a few feet below the surface. A simple winding stone stairway, the width of one's shoulders, leads downward between the tall slabs of antique tombs into a corridor below, at the only entrance to which, piled neatly at one end, are a thousand jawless skulls and thigh bones. At the other end of this corridor one enters into a second vaulted corridor,



The Streets of Guanajuato Are Steep and Tortuous, and There Is an Infinity of Steps

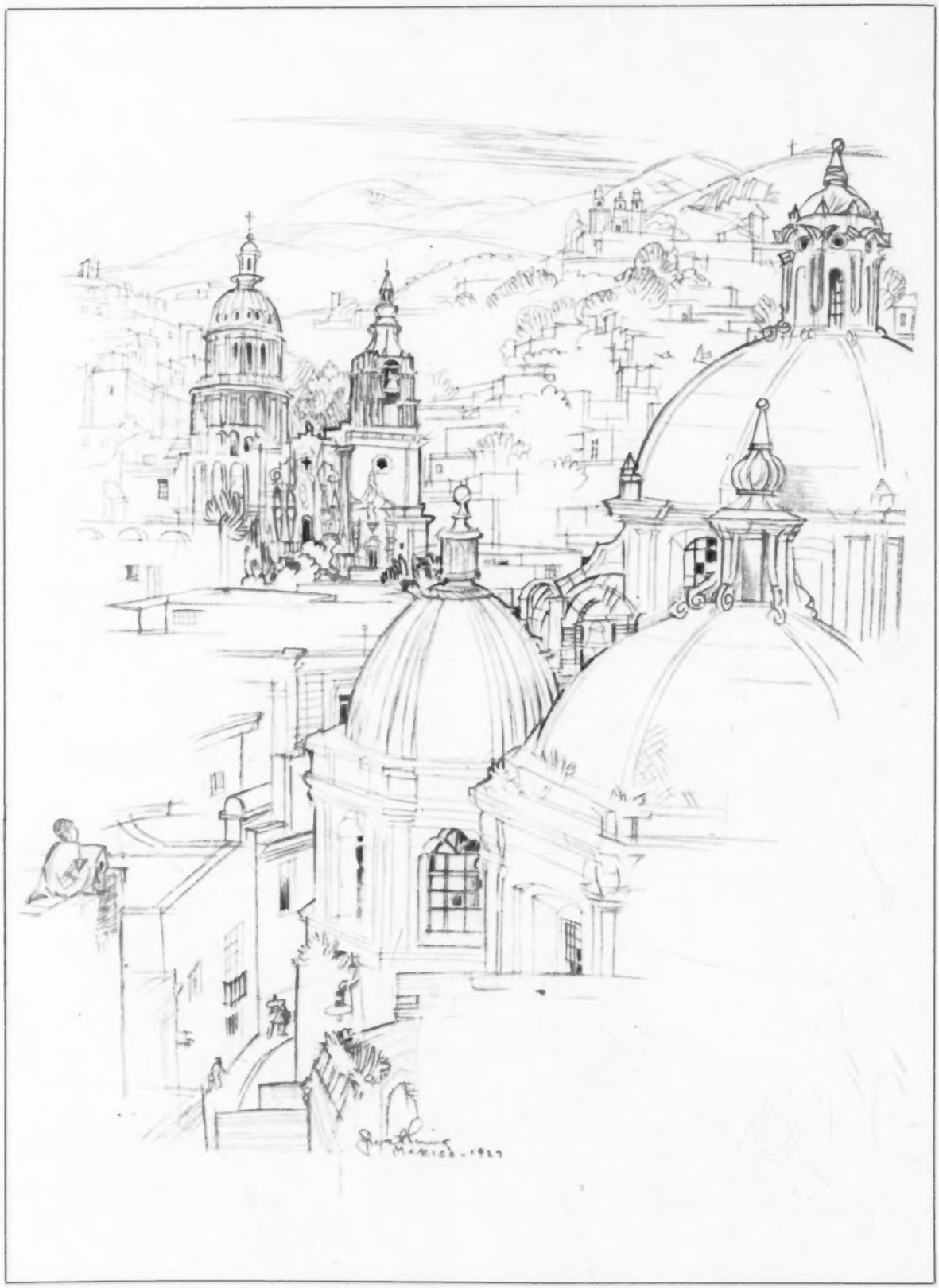
From a Pencil Sketch by William P. Spratling



Squeezed in Between Jagged Hills, Guanajuato Lies in a Rugged Valley

From a Pencil Sketch by William P. Spratling

UNIV. OF MICH.



Editor's Note: Looking down upon an accumulation of beautiful old buildings with glazed domes and towers, it is a constant strain not to miss some angle of the scene, everything being constantly different and of such absorbing interest. There is nothing jarring, inharmonious or artistically offensive in Guanajuato, the most Mexican city

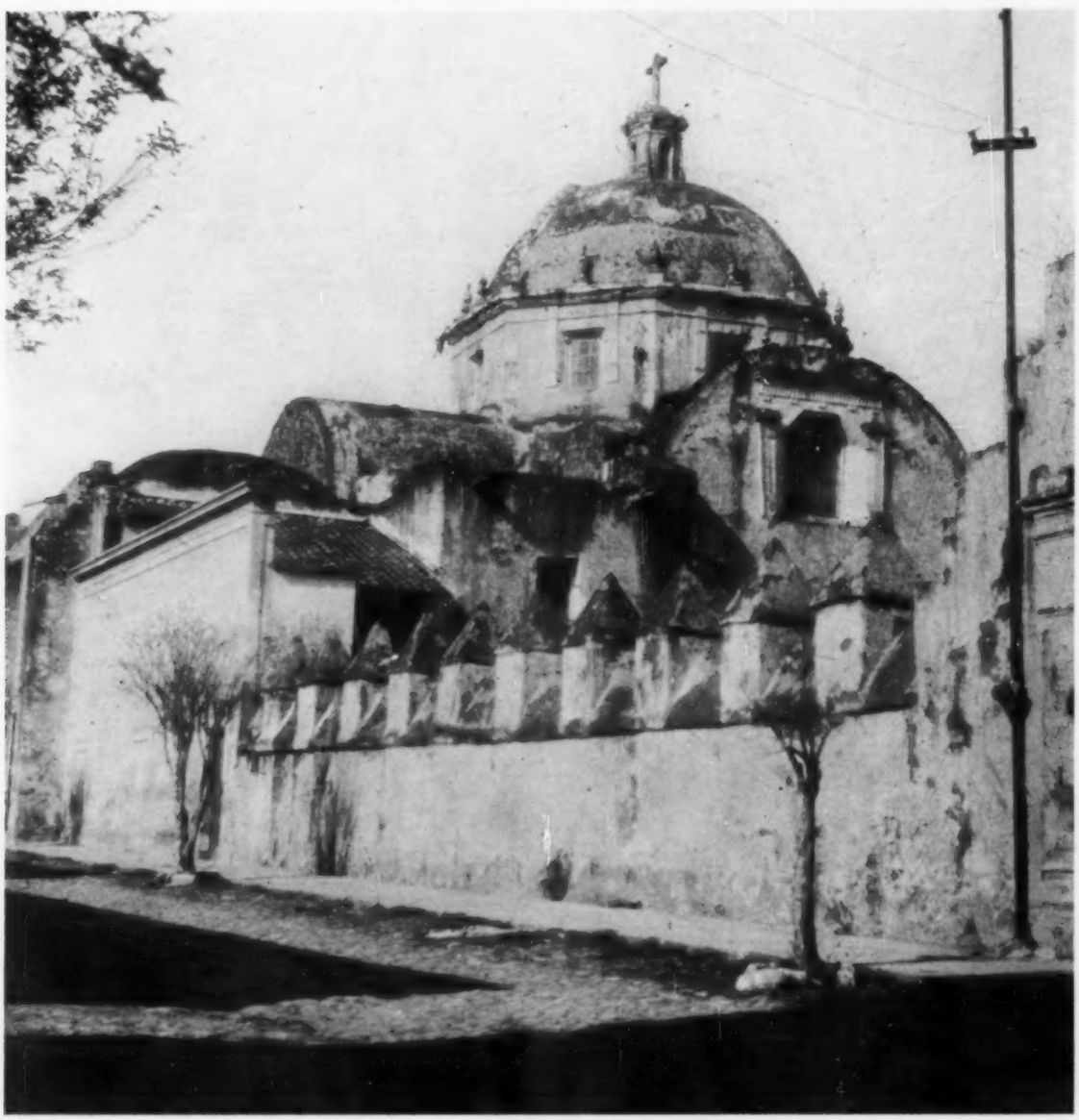
From a Pencil Sketch by William P. Spratling

Editor's Note: High iron fences and ornamental grille gates often enclose the elaborate Ultra-*Baroco* entrances to the high domed churches and cathedrals of Guanajuato, the most picturesque and beautiful city in Mexico

From a Pencil Sketch by William P. Spratling

perhaps 6 feet wide, to be grinned at in close intimacy by a hundred gesturing mummies. Here are men who were once fat, now flat and in shrunken folds, with tongues protruding and fleshless digits; babies, their bright dresses still on, standing on flattened little tubes of legs. They all stand or rather lean, on their heels, quite stiffly, against the pale blue walls. The effect is horrible and indescribable, and the fresh air becomes necessary for well-being.

But in my memory of Guanajuato there are also many other things,—splashing in the great stone pools of the Alameda, the brown bodies of Indian youths flashing in the sun. Above, an Italian blue sky and mountains towering, bristling with tall cactus. Below is a walk winding downward, beside which runs the silver thread of a small stream. There is a gigantic growth of tropical gardens, with many stone bridges of primitive shapes. The declivities are steep and tortuous, and there is an infinity of steps,—steps frequently ingeniously contrived. It is a city of steps. There are more stepped streets in Guanajuato than there are bridges in Venice! Up them, driven by Indians, with simple white clothes and bright *serapes,* go small trains of burros laden with casks of wine, with loads of wood,—arranged with match-like precision,—and with individual mountains of hay in nets. Automobiles find Guanajuato's streets difficult. It is not a place intended for them, and they look as awkward and uncomfortable lumbering around the narrow slanting byways, as country clowns in a boudoir. As for myself, I found Guanajuato so rare in its beauty that my only regret was that I did not have the leisure in which to put more of the things that I saw there on paper.



High Domes and Vaulted Roofs Tower Above Fortress-like Walls and Parapets

MEXICO AND THE ULTRA-BAROCO

BY

DR. ATL

FORMER DIRECTOR OF FINE ARTS AND MINISTER OF EDUCATION IN THE MEXICAN GOVERNMENT

THE religious architecture in "New Spain" was initiated in the very first days of the Conquest with the erection of modest adobe-built oratories. Its development was carried on during those years under the exclusive influence of European styles, imported since the early days of the conquerors, and it reached, starting from 1640, a prodigious development which finished in 1700 with the magnificent florescence which we recognize as typically Mexican. These works, inspired directly by the European styles, were nearly all erected between 1540 and 1620 and form a series of types of great artistic interest but lacking the imprint of native impulse. Beginning in 1620, the religious buildings are simple structures of very elementary character, generally built upon rectangular plans and without a well fixed scheme of arrangement or ornamentation. The number of these structures constantly increased until 1650, from which date on to 1700 construction was constantly accelerated, and it finally reached its amazing maximum of ten churches monthly.

At the beginning of the eighteenth century the political and religious unification of the colony had been completed. The ideals and interests of the new social group formed in "New Spain" were crystallized, and this crystallization was meant to be the base of the development of a new and magnificent art, essentially Mexican. Some of the artistic virtues which were native, and others born from the blending of the two races—the native and the Spanish—had their first distinct and independent expressions in this architectural development. The Catholic Church had consolidated its power, and its wealth was enormous. The moment was propitious for a great artistic expression, one which transformed the styles imported from Europe and blended them with a very real national sentiment. On the vast territory of "New Spain," during the eighteenth century, and, at the same time in other regions, thousands of churches were erected having fundamentally the same characteristics—confessing the same origins—revealing the same tendencies; buildings which were almost always anonymous, and which distinguish themselves at a single glance from the Italian and Spanish buildings from which they had derived some manners of construction and ornamentation. The fundamental elements of the religious architecture of the seventeenth century are of *Baroco* origin, but the master builders, the anonymous masons and the great architects, exaggerated the original forms and covered them with a richly imaginative decoration, transforming the facades, towers and cupolas of the churches, and resulting frequently in "ornamental explosions."

On the other hand, and with the exception of great churches erected by known architects and constructed along perfectly definite plans, the immense majority of churches of the eighteenth century are true *"obras de acumulacion,"* extremely asymmetrical and of a lineal expression which is energetic and at the same time accentuated by the vigorous eloquence of polychromy. This manifestation has been classified by those interested in Colonial architecture under the denomination of *"Estilo Churrigueresco," "Estilo Plateresco," "Baroco Espanol,"* etc. There is nothing more absurd. The series of architectural works of the seventeenth century have essentially Mexican characteristics and cannot be confused with those of Churriguera, Tome, Pedro Ribera, Miguel de Figueroa, etc. In my monographs *"Iglesias y Conventos de Mexico,"* published under the patronage of the Treasury Department of the Mexican government, are more fully given the reasons which induced the establishment of the new classification and which define more logically these characteristics of the seventeenth century production. After a vast comparative study among Mexican works, in which I am still engaged, and of the products of the Italian *Baroco,* the Spanish *Baroco,* and the so called *"Escuela Salamantina,"* and after examining closely the special forms of the new artistic product, I considered it logical to include the eighteenth century's productions under a denomination which would correspond exactly to their character and which will determine exactly their origin and their tendencies. I have called it "Ultra-*Baroco*" with which is indicated a derivation of the *Baroco,* and,—which is more important,—that it proceeds further. The Ultra-*Baroco* is expressed by exaggerated movements of the masses, by abundance of ornamental motifs, by vigor of chiaroscuro, by the invariable desire for vibration and depth, by the ascendent rhythm of the frontispieces, by the tendency to terminate the facades and the walls with *ondulant* profiles which are invariably dominated by the magnificence of a polychromed cupola and dome. This means that the builder of the seventeenth century, famous architect or anonymous mason, expressed himself in Mexico in a language of *Baroco* origin, but enriched it by a profound æsthetic sentiment which is tropical and therefore distinctly and characteristically Mexican.

William P. Spratling, since the first days of his arrival in Mexico, was strongly attracted by the aspect of the Ultra-*Baroco* constructions. After several trips to different regions of the republic, he seems to have had the artistic sensibility to grasp the constructive tendencies and the plastic value of this truly Mexican style, to which are related the greater part of the admirable drawings which illustrate this article and others by him previously published in THE ARCHITECTURAL FORUM. There is

no form more adequate to translate to a public the true aspect of the picturesque Mexican churches than that chosen by Mr. Spratling. His drawings, deeply sensitive, probably express much more as regards clear facts than any other possible form of graphic reproduction. The cupola, which is one of the most important manifestations of the Ultra-*Baroco,* an obsession of the builders of the sevententh century, seems also rather an obsession with Mr. Spratling. In the pages of this magazine he has shown from time to time some very rare examples. The cupolas, rising above the naves of the temples, represent the spiritual expansion of a religious sentiment. Born in the East and transplanted to the Occident, the cupola flourished above the churches in the countries of the sun and had one of its greatest expressions over the polychromed walls of Santa Maria dei Fiori. Transported to Mexico, this exquisite architectural conception was developed on the old Anahuac land,—which had not known the curve,—and there flourished prodigiously. Mexico has nearly 15,000 cupolas!

Wandering through the wonderful provinces of the republic, as has Mr. Spratling only recently, and from which journeyings there have been such wonderful fruits, is an experience sufficient to convince one that in these Mexican things are encountered manifestations disclosing a new plastic value and one hitherto unclassified. As a matter of fact, the Ultra-*Baroco* represents the first intellectual effort of "New Spain." It might almost be said that the Ultra-*Baroco* in Mexico constitutes, with its innumerable examples, an intermediate point between the Aztec Teocali and the New York skyscrapers It is a unique fact that in the creation of the Ultra-*Baroco* there was won architectural independence preceding by a whole century the political independence of Mexico.

High Walls Are Dominated by the Magnificence of a Cupola or Dome, as in This Church at Chihuahua

THREE HOUSES IN THE "MEDITERRANEAN" STYLE—NO. 1

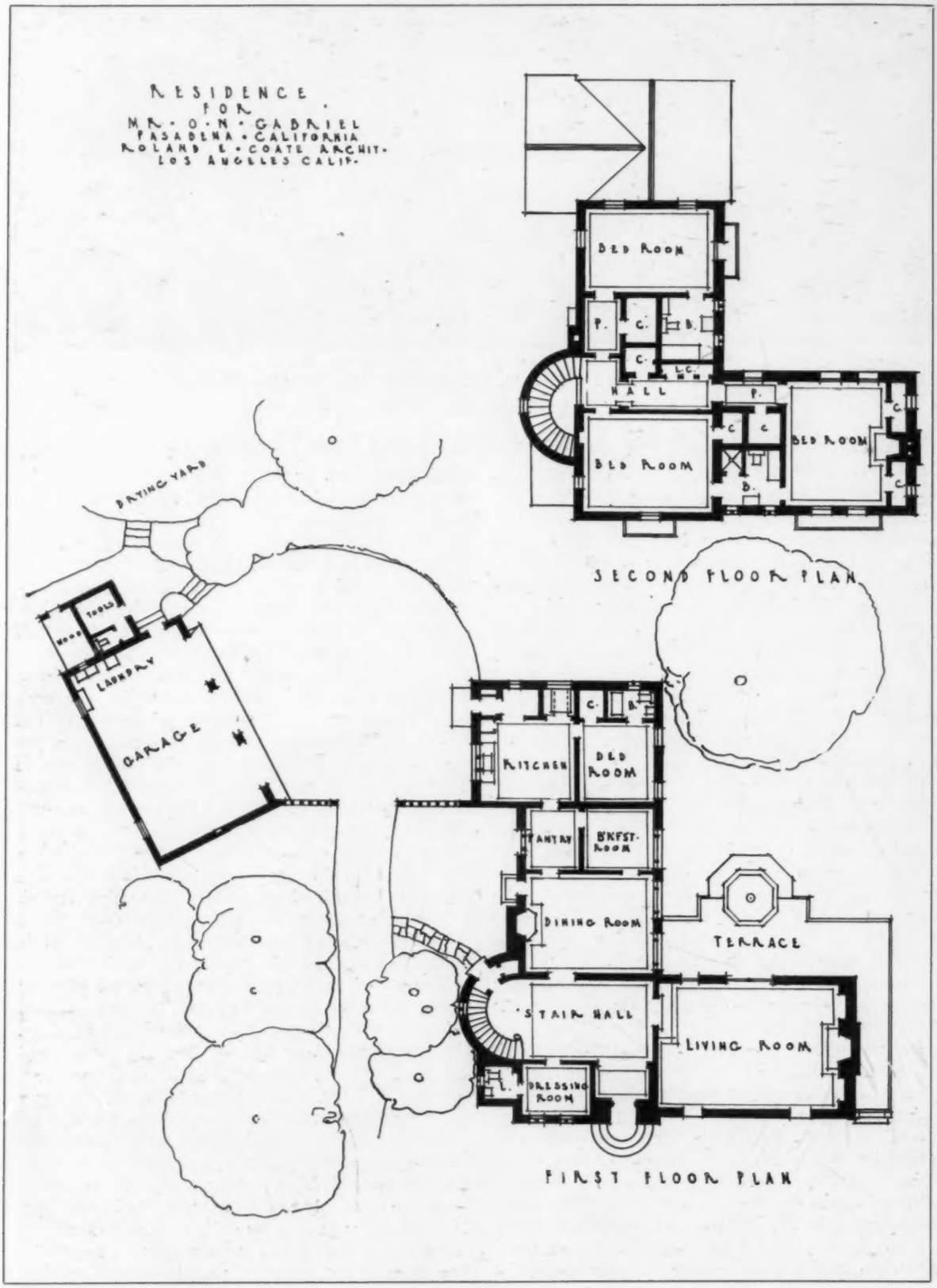
House of O. N. Gabriel, Esq., San Marino, Calif.

Roland E. Coate, Architect

THE consistent and successful use of the "Mediterranean" style in American domestic architecture is nowhere seen to better advantage than in this unusually artistic house of Mr. Gabriel's in San Marino, Calif. The house, which is remarkable in plan, is so located that many of the original trees on the site have been preserved to add charm and picturesqueness to the setting. Unlike the majority of Spanish and Italian houses in southern California, this building is constructed of brick painted white instead of the usual stucco-covered tile more frequently used. The roof of Spanish tile, the iron balconies and the green shutters contrast pleasantly with the white of the walls. The one-story service wing which contains the kitchen, pantries, servant's bedroom and bath, emphasizes the height and importance of the main portion of the house. The plan of the first floor is so laid out that the living room and dining room both open onto a terrace, with a central fountain located in the angle formed by the main house and the living room wing. Three large arches, which open out of the dining room and breakfast room, make a picturesque background for this terrace. On the other wall of this court a large rectangular window and small door indicate the location of the living room.

Although the design of this house is dis-symetrical, the windows and doors are so carefully studied as to scale, location and centering that there is a definite note of formality about this otherwise informal lay-out. The same restraint and stylistic conservatism are shown in the interior architecture. Black and white marble floors, soft tinted stucco walls and gaily painted coffered ceilings produce a "Mediterranean" atmosphere in which the massive Italian and Spanish furniture is in perfect keeping. To properly appreciate the unusual charm of this delightful house, these illustrations should be reproduced in color; unfortunately, the richness and harmony of the color combinations can only be imagined. Added height is secured for the living room by dropping the floor two steps below the level of the rest of the first floor. The entrance hall with its semi-circular stairway is almost as large and impressive as the living room. It is to be regretted that no illustrations of the dining room were obtainable, as this room, judging from the plan, must be unusually interesting. One end is occupied by the two great arches which overlook the terrace, and a massive fireplace occupies the center of the opposite wall. Even the small doors into the pantry and breakfast room balance each other at similar distances from each corner of the room. Probably some personal preference on the part of the owner necessitated the placing of the large arched doorway from the stair hall into this room considerably off center. The bay of the semi-circular stairway forms an interesting architectural feature on the exterior of the house. Under the stairs there is conveniently located a side door, which leads out toward the garage and service courtyard.

The high fence with its tall brick piers and turned spindles is one of the picturesque details of this fascinating architectural group. Penetrations in the brickwork of both house and garage are pleasant decorative notes, as are also the black-painted iron balconies with their gay striped curtain awnings. On the second floor are located three good-sized master bedrooms, two baths, and many spacious closets. So large is the master portion of this house on both the first and second floors that it would seem necessary to have more than one servant in permanent residence, although only one servant's bedroom has been provided. The picturesque charm of this house can be readily appreciated from the illustrations. Most of the appeal of the design is due to the large amount of unbroken wall surface and to the carefully proportioned and properly located door and window openings. It is to be wished that more of the California houses built from designs inspired by Spanish architecture could be as satisfying as this house.



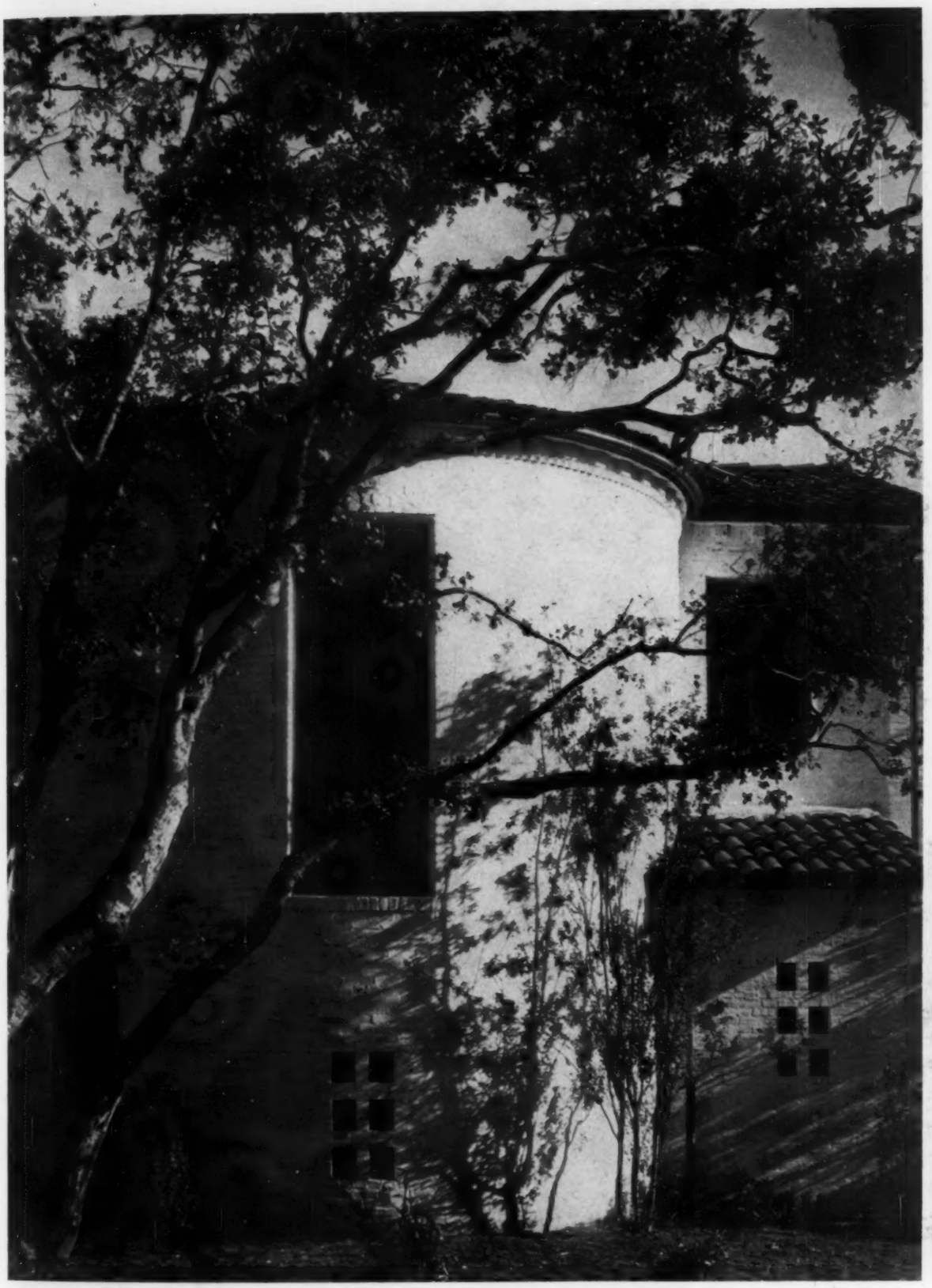
Editor's Note: The plot plan was laid out to save all large trees on the property. Service courtyard and garage logically located at rear of house. Living terrace and garden have proper privacy and seclusion. A well planned house, well placed

ENTRANCE PORCH FROM DRIVEWAY. OPEN DESIGNS IN THE BRICKWORK REPLACE WINDOWS

HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.

ROLAND E. COATE, ARCHITECT

CORNER OF THE LIVING ROOM WING AND NARROW TERRACE LEADING TO THE GARDEN
HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.
ROLAND E. COATE, ARCHITECT

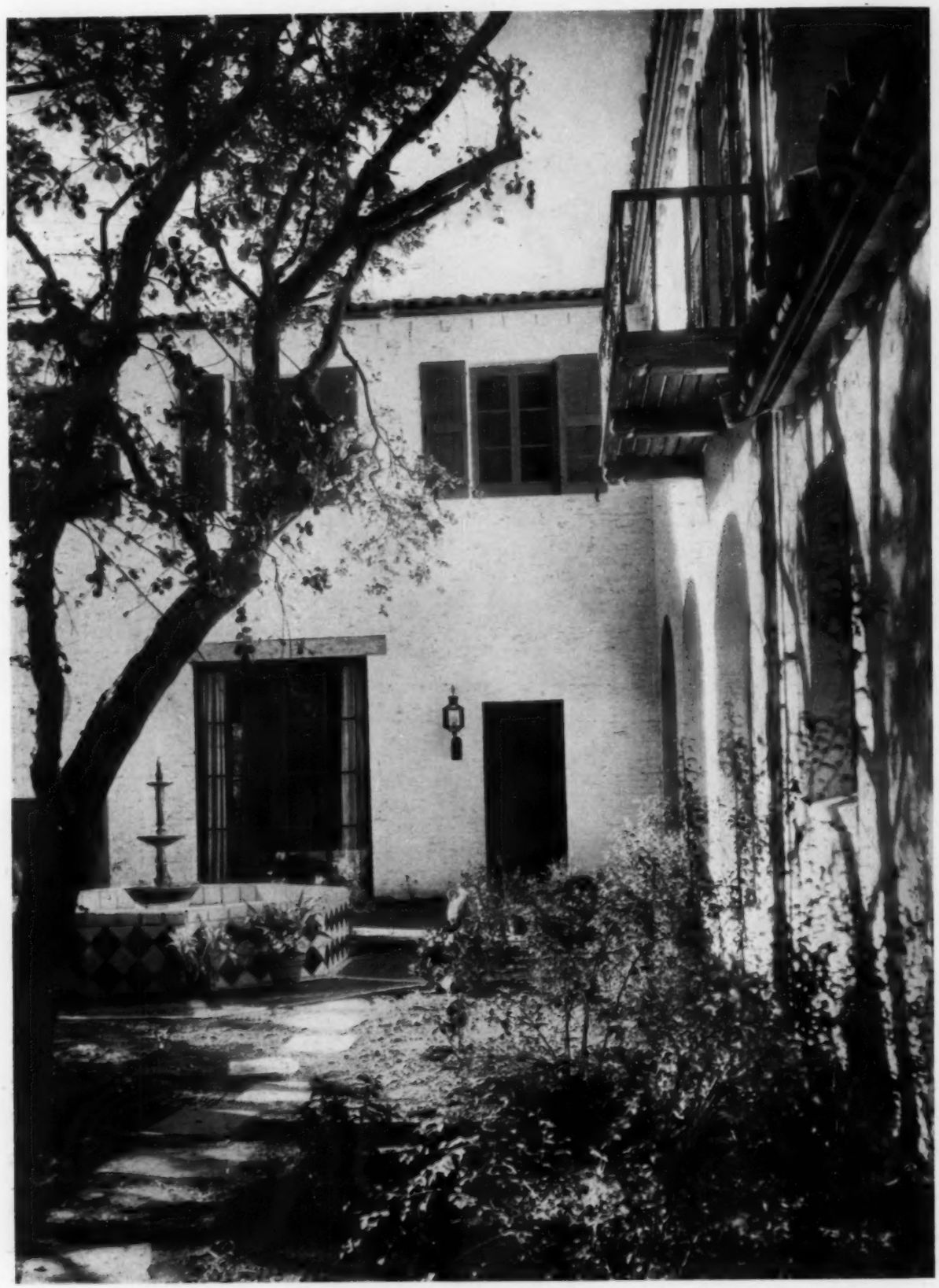


THE LEADED GLASS IN WINDOW OF STAIR HALL BAY IS BARELY DISCERNIBLE IN THIS ILLUSTRATION

HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.

ROLAND E. COATE, ARCHITECT

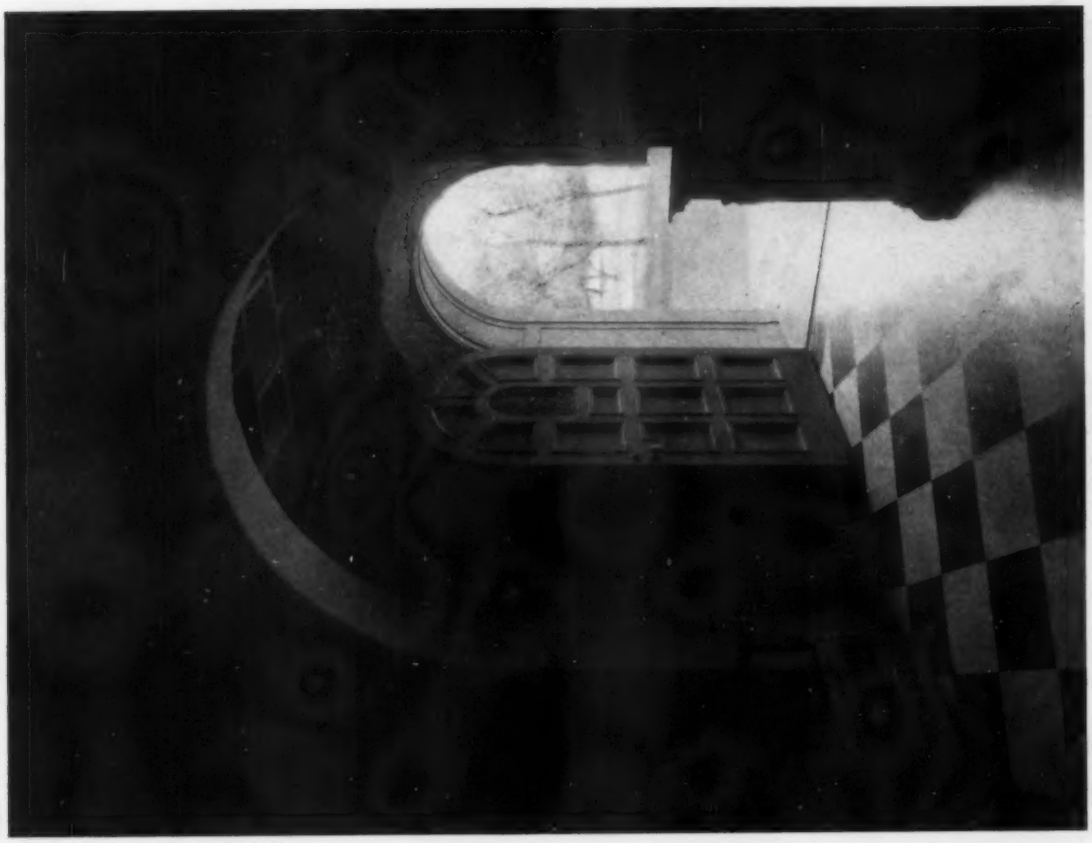
UNIV. OF MICH.



A CORNER OF THE GARDEN TERRACE, WITH SPANISH FOUNTAIN AS THE CENTRAL FEATURE
HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.
ROLAND E. COATE, ARCHITECT

GATEWAY AND WALL BETWEEN THE HOUSE AND SERVICE COURTYARD
HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.
ROLAND E. COATE, ARCHITECT

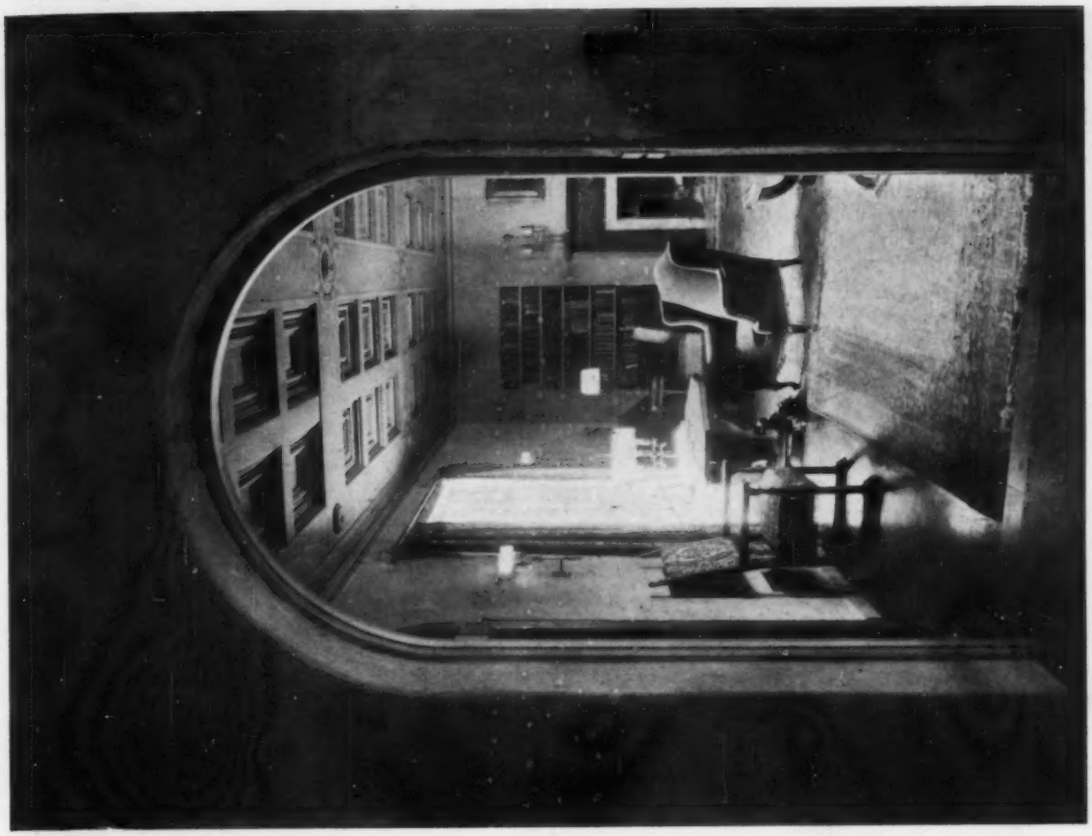
BANK OF MICH



ENTRANCE VESTIBULE

MAIN STAIRWAY

HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.
ROLAND E. COATE, ARCHITECT



LOOKING INTO LIVING ROOM

STAIR HALL FROM LIVING ROOM

HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.
ROLAND E. COATE, ARCHITECT

THE GARDEN TERRACE

GARAGE AND GATEWAY TO SERVICE COURT

HOUSE OF O. N. GABRIEL, ESQ., SAN MARINO, CALIF.

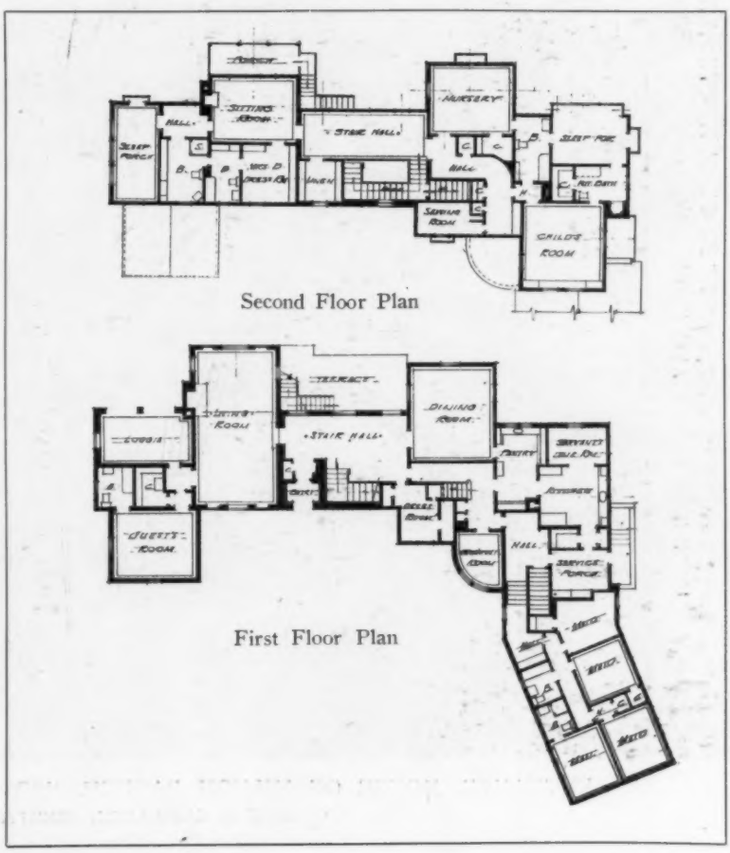
ROLAND E. COATE, ARCHITECT

THREE HOUSES IN THE "MEDITERRANEAN STYLE"—No. 2

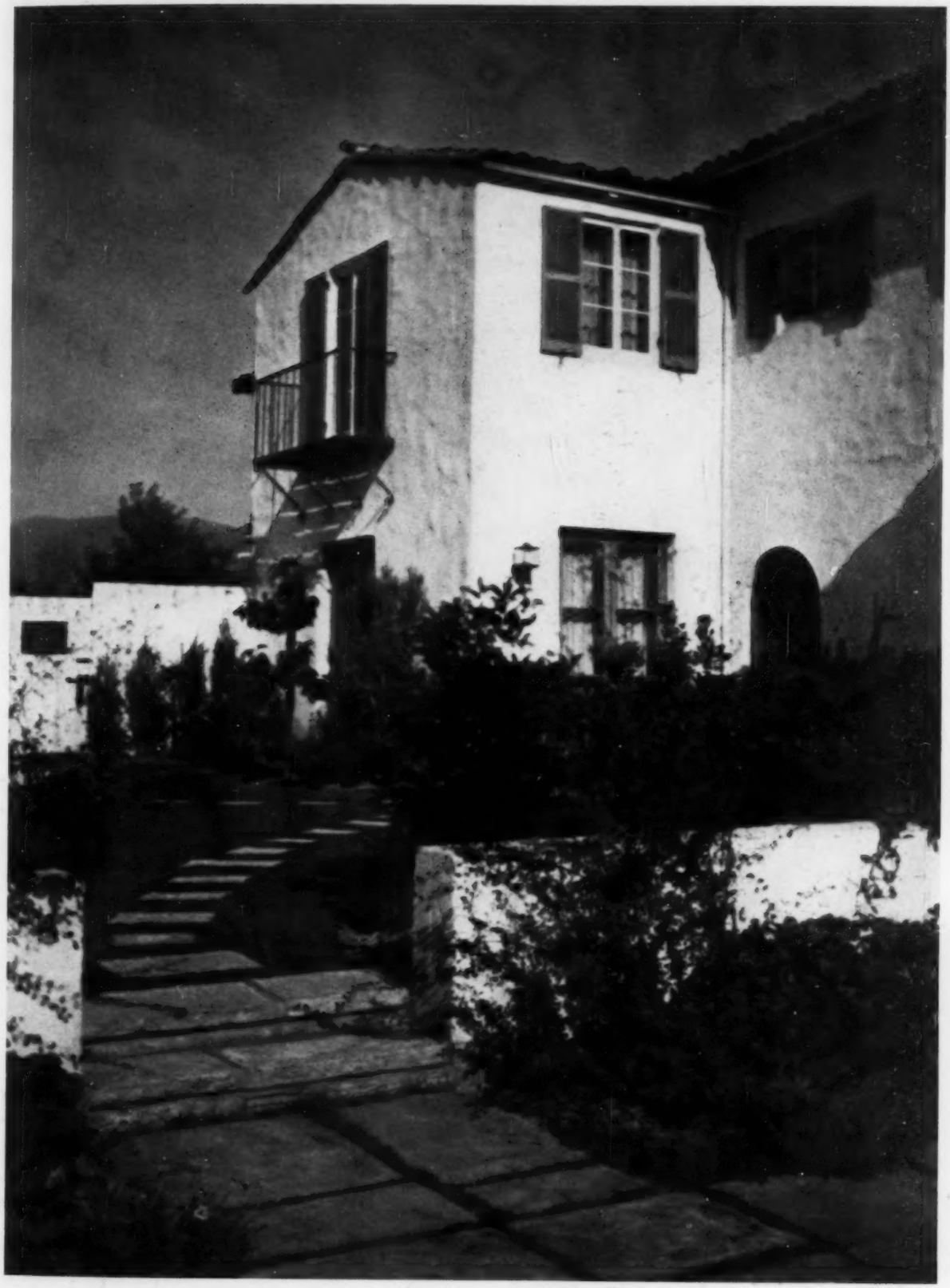
House of Milton Baruch, Esq., Holmby Hills, Calif.

Gordon B. Kaufmann, Architect

RESERVE and refinement produce the charming simplicity of this house at Holmby Hills. From the illustrations it might be thought that this is a house of moderate size. As a matter of fact, it rambles over a great many square feet of ground. It is a house designed for recreation and entertainment. In the long, one-story wing rooms are provided for four servants. People who build homes for themselves, if they desire freedom from the servant problem, should make them thoroughly comfortable, and follow the example laid down in this plan, where not only are the four servants' rooms of more than average size, but where also a dining room and a porch, which appears on the plan more like an additional room, are provided for the comfort and convenience of the servants. Although this house is of tile covered with stucco instead of brick painted white, it shows many of the characteristics in its design that are found in the house of Mr. Gabriel at San Marino. From every point of view, this house has a distinctly picturesque quality, as may be seen from these illustrations.



ENTRANCE, HOUSE OF MILTON BARUCH, ESQ., HOLMBY HILLS, CALIF.
GORDON B. KAUFMANN, ARCHITECT



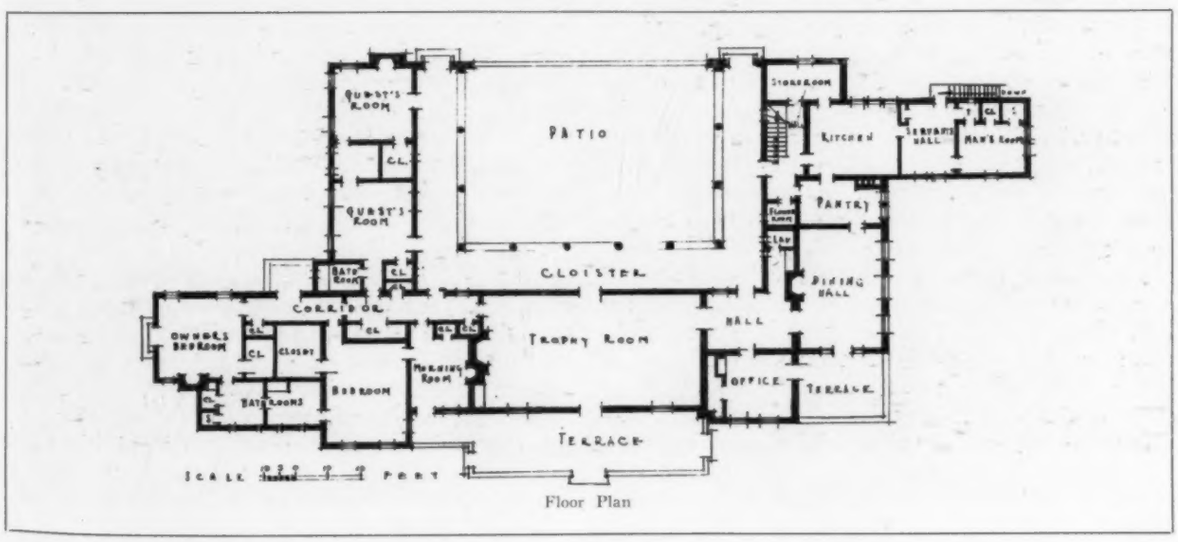
GARDEN TERRACE, HOUSE OF MILTON BARUCH, ESQ., HOLMBY HILLS, CALIF.
GORDON B. KAUFMANN, ARCHITECT

LOGGIA, HOUSE OF MILTON BARUCH, ESQ., HOLMBY HILLS, CALIF.
GORDON B. KAUFMANN, ARCHITECT

THREE HOUSES IN THE "MEDITERRANEAN STYLE" — No. 3

House of Max Fleischman, Esq., Montecito

Johnson, Kaufmann & Coate, Architects



Floor Plan

Corner of Patio and Cloister

Steps at End of Patio Cloister

WITH the mountains and valleys of Montecito as the setting, it is not surprising that an architect could be inspired to create a house of unusually artistic and picturesque quality. In any case, it is evident that the architects who designed this wide, spreading, one-story house for Mr. Fleischman were inspired to create a design in which details rather severe and formal in themselves are so artistically combined as to produce a house almost theatrical in its picturesqueness. Who can explain why an arched opening has so much more appeal to the artistic eye than the flat-top or rectangular opening? Certain it is that no prettier picture could be imagined than the view of the verdant valleys and rose-tinted mountains enframed by the open archways at each end of the covered walk or cloister that surrounds the broad patio. This patio logically separates the dining and service part of this one-story house from the master's or living part. A large center hall, known as the "trophy room," over 40 feet in length, connects the two parts of this plan. The four bedrooms, several baths, large closets and the morning room occupy the master's part of the plan. The side hall, office, large dining room, pantry, kitchen, store room and the servants' quarters occupy the other half of the house. As only one servant's room appears in the plan, it is presumed that quarters outside the house must be provided for more servants.

Most of the pleasing quality of the exterior design is due to the large amount of unbroken wall area and to the care taken in the proportions, scale and locations of the several door and window openings. Such all-important factors in good design as scale and proportion are almost impossible to teach. No hard and fast rules for these primary essentials can be laid down. They are the product of innate good taste and artistic appreciation. The evidence of these characteristics is particularly evident in the details of the entrance facade, where two windows with green shutters balance a center entrance door. This excellently proportioned opening is balanced by an interesting lantern on each side and is given added importance by the rainwater leaders which are so located that they purposely divide the design of the entrance front into three parts. To give scale to these three principal openings on the front facade and to break the bareness of the high wall spaces above these three openings, small, square, porthole-like windows are introduced just below the overhanging eaves. The broad terrace at the front of the house, which gives an appearance of solidity and permanency, further adds to the distinctly architectural quality of the entrance front. The architects were doubly fortunate, as not only the views of the surrounding country on every side were beautiful, but the actual site itself possessed many old trees of picturesque shape and character. It is indeed a pity that houses designed in the Italian and Spanish styles are not consistent with the climate and life in most sections of our country except Florida and California.

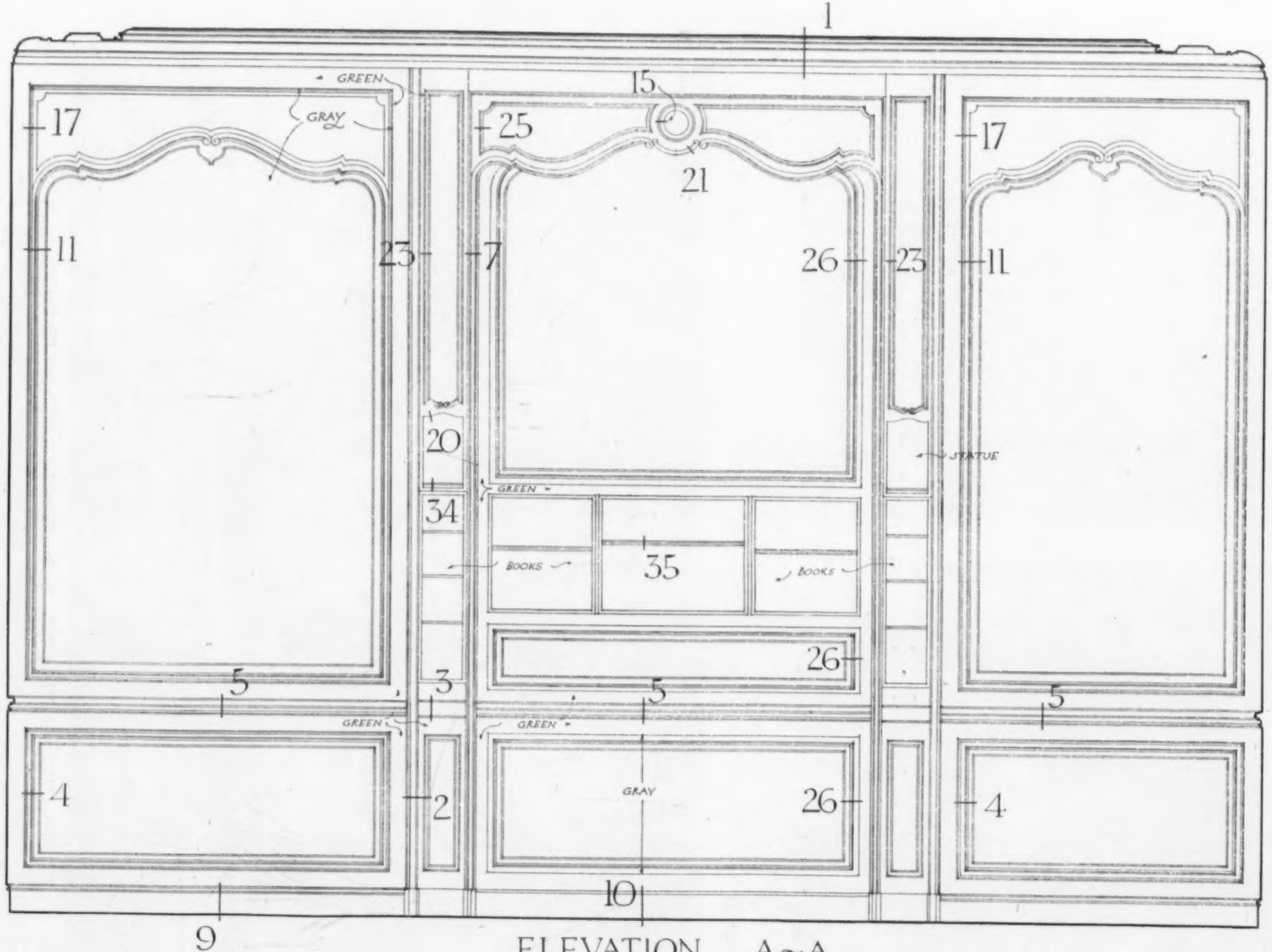
INTERIOR ARCHITECTURE

SALLE PERRIN, MUSEE DES ARTS DECORATIFS, PARIS

TEXT AND MEASURED DRAWINGS BY
C. HAMILTON PRESTON

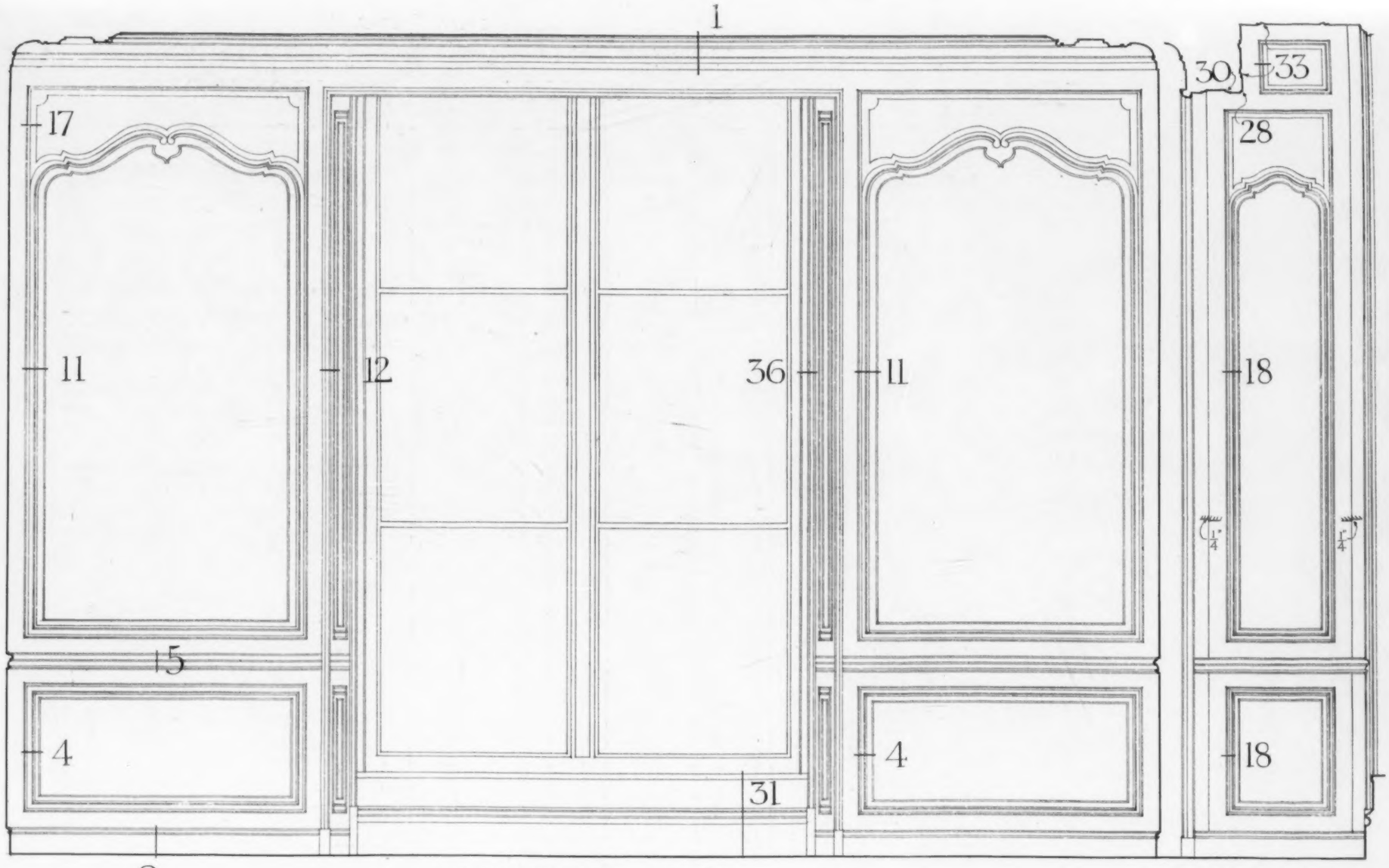
IN the extreme western part of the Louvre one finds a huge wing devoted entirely to the history of the development of interior architecture and decoration from the earliest times to the present day. This wing is known as the Musee des Arts Decoratifs. The subject of these measured drawings is found in the purely eighteenth century section of this wing. Here a series of rooms has been arranged, some antique, and some modern copies of antique rooms, to serve as settings for the priceless collections of art objects and decorations which have been brought together here to exemplify the beauty of the various periods of this unparalleled era. One of these rooms is the Salle Perrin, perhaps the most interesting of them all. It is a copy of an antique room in the possession of the donor, M. Perrin, and was given as a memorial to his son. Of the Louis XV period, it is unique in both design and color. One sees at a glance that it is rather provincial in character and yet of finish and refinement in design, possessing nothing of the seeming crudity of much of the provincial work. In its conception it is extremely broad and vigorous. Rarely does one find such breadth of paneling, such varied and long forms of curves; in fact it is almost Georgian in feeling. It is a room of the utmost distinction and forms a very fitting setting for the beautiful objects with which it is filled. The end opposite the window and illustrated with this text gives, from the point of view of design, the keynote of the room. In the center we find a shallow niche, flanked by small recesses or subordinate niches into which books are set, surmounted by brilliantly colored Buddhas. The books are in brass rimmed bookcases, very delicate in scale, both in these flanking niches and in the rear of the large niche. As will be seen from the sketches, this niche, which has a sloping soffit and is exquisitely paneled, forms a setting for the beautiful Louis XVI desk which occupies it. The two adjacent sides are fittingly paneled to receive the furniture and decorations with which they are adorned, while the fourth has been ingeniously designed to incorporate one of the huge windows of the Louvre. The stiles are dark olive green, mottled, and all panels and mouldings are of a warm gray, which is slightly marbleized.

Wall with Niche, Salle Perrin, Musee des Arts Decoratifs, Paris



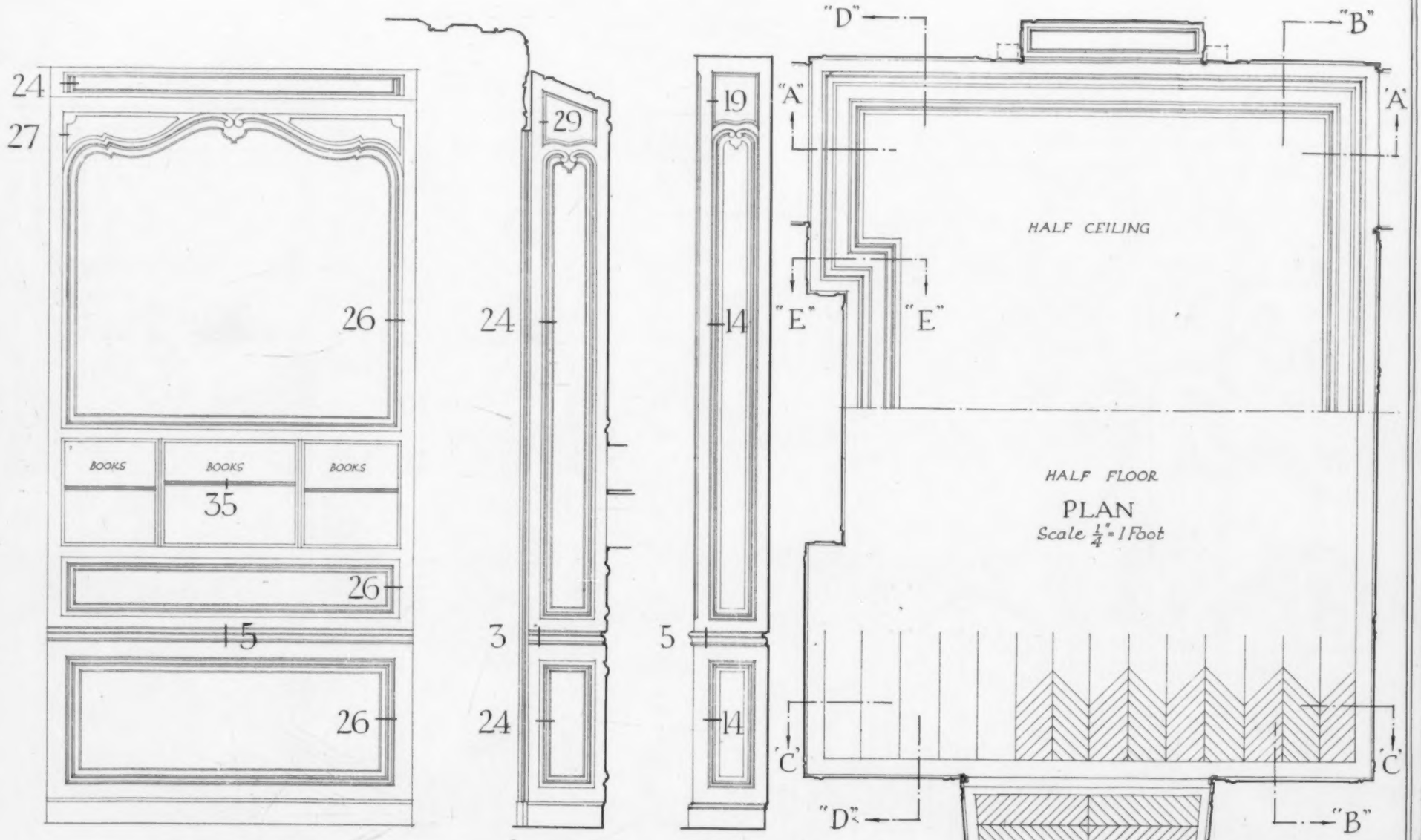
ELEVATION A~A
SALLE PERRIN
MUSEE DES ARTS DECORATIFS
PARIS
Scale 1/2" = 1 Foot

PARIS
Scale ½"=1 Foot



ELEVATION C~C
SALLE PERRIN
MUSEE DES ARTS DECORATIFS
PARIS
Scale ½"=1 Foot

SECTION THRU
WINDOW



ELEVATION OF BACK OF NICHE

SECTION THRU NICHE

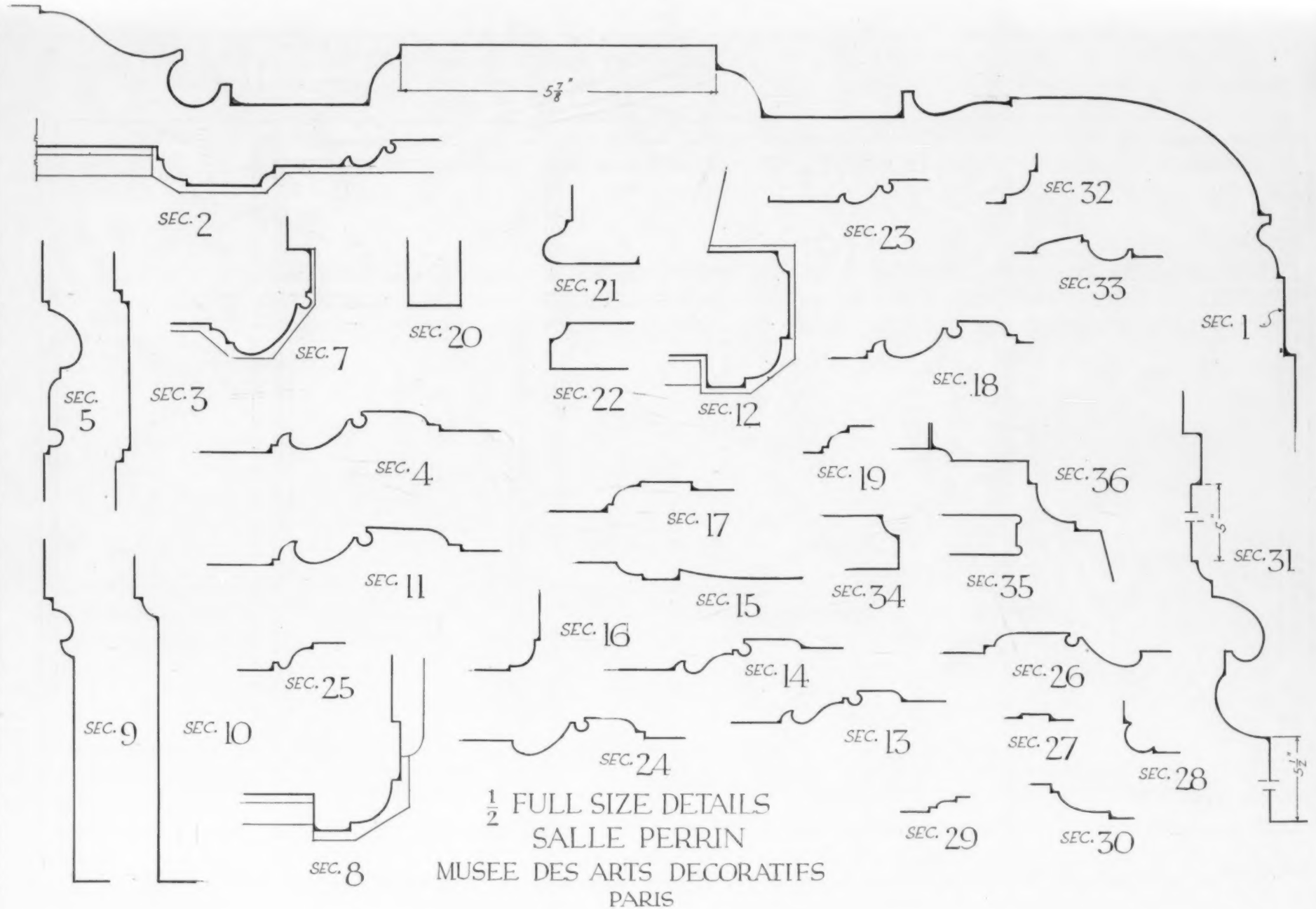
ELEV. "E~E"

Scale $\frac{1}{2}$" = 1 Foot

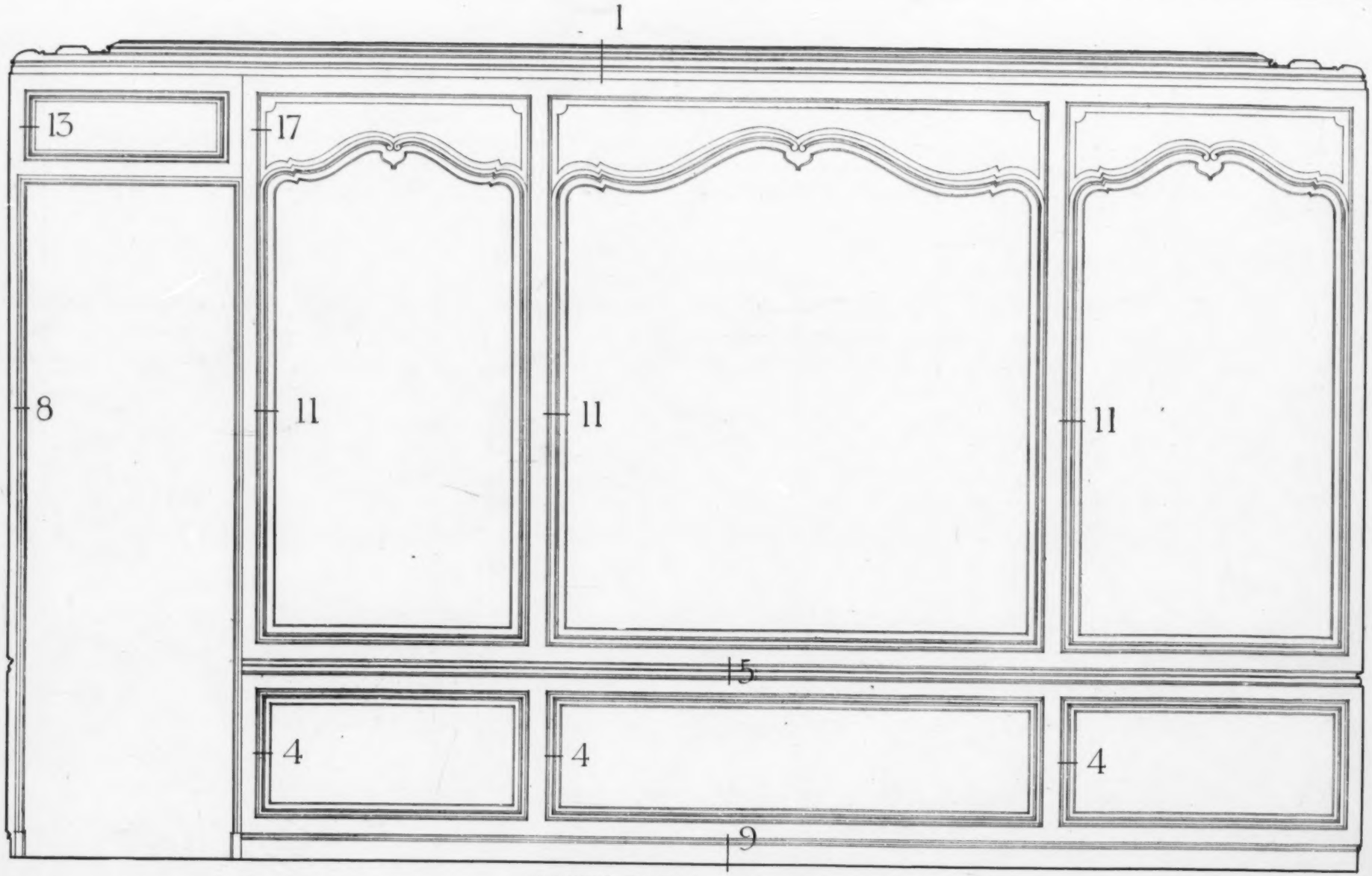
PLAN

Scale $\frac{1}{4}$" = 1 Foot

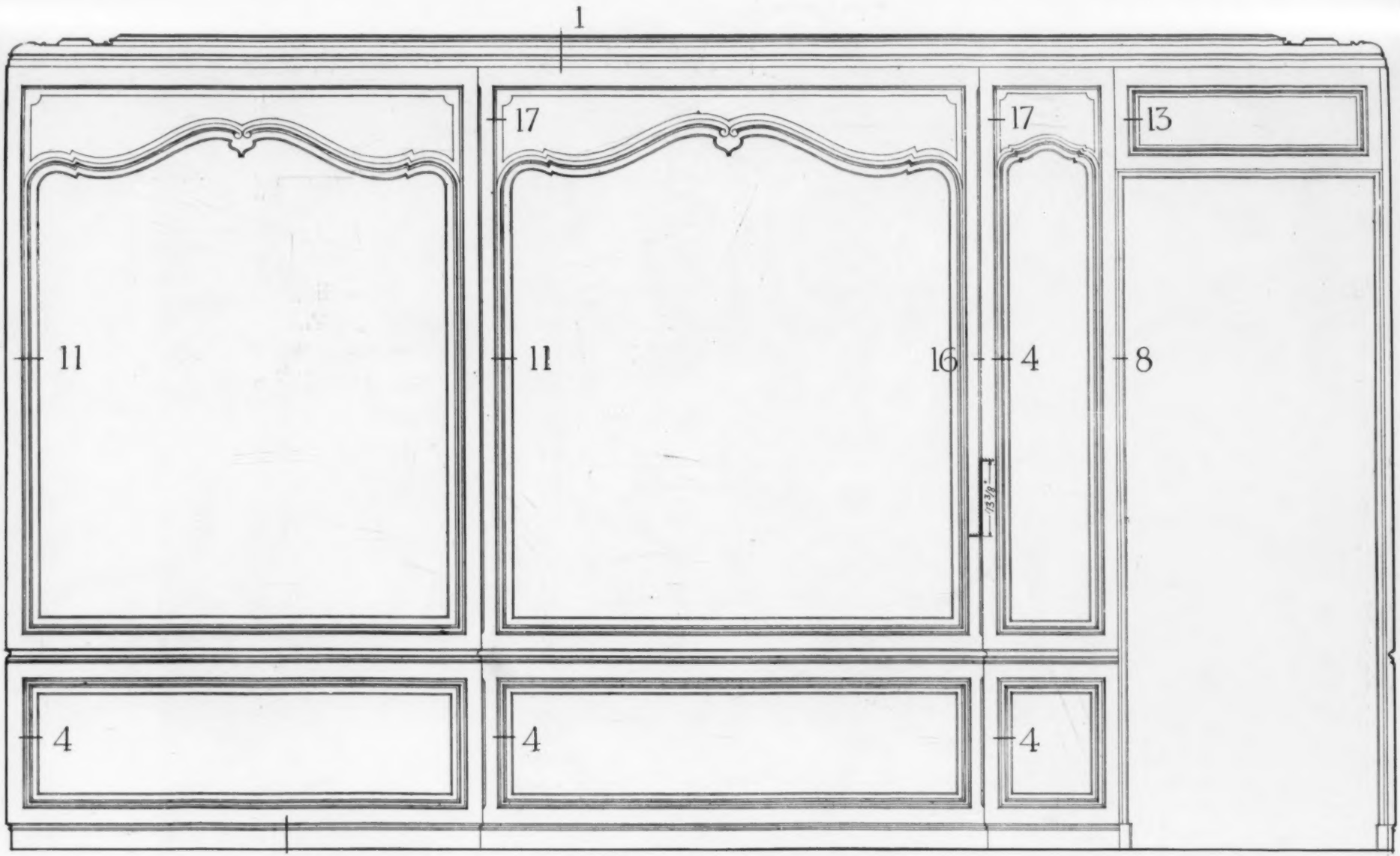
SALLE PERRIN
MUSEE DES ARTS DECORATIFS
PARIS



½ FULL SIZE DETAILS
SALLE PERRIN
MUSEE DES ARTS DECORATIFS
PARIS



ELEVATION B~B
SALLE PERRIN
MUSEE DES ARTS DECORATIFS
PARIS
Scale ½" = 1 Foot



ELEVATION D~D
SALLE PERRIN
MUSEE DES ARTS DECORATIFS
PARIS
Scale ½" - 1 Foot

See Illustration on Next Page

EMPHASIS IS GIVEN BY THE SLIGHT PROJECTION OF THE CENTER PANELING ON ONE WALL OF THE SALLE PERRIN, MUSEE DES ARTS DECORATIFS, PARIS

Photo. George H. Van Anda

SKELETON CONSTRUCTION, "TUDOR CITY," NEW YORK
FRED F. FRENCH CO., ARCHITECTS

The Architectural Forum

THE
ARCHITECTURAL
FORUM

VOLUME XLVIII NUMBER TWO

FEBRUARY 1928

OIL BURNING FOR THE ARCHITECT

PART 1. WHAT THE OIL BURNER IS AND WHAT IT DOES

BY
P. E. FANSLER
ASSOCIATE EDITOR, THE HEATING AND VENTILATING MAGAZINE

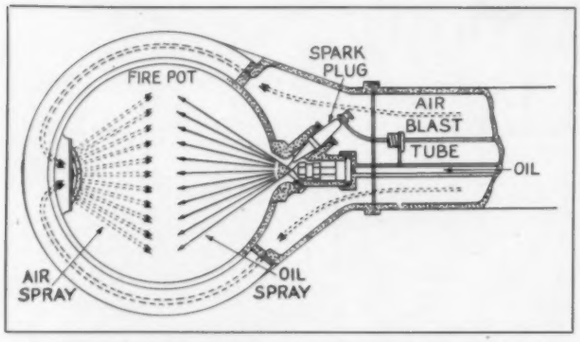
SO frequently is the architect asked by a client for data on the use of oil fuel for domestic use, or for a specific recommendation or opinion relative to this burner or another, that it has become necessary for him to acquire accurate knowledge of this subject. So many types and so-called types of oil burners are being exploited that the architect should be able to describe to his client in simple terms the basic principles of operation, the outstanding merits of the different types, and the definite limitations of this form of heat production. It is, therefore, proposed rapidly to sketch the essentials; then to summarize the pros and cons.

Of the houses built during 1927, it is estimated that 110,000 were constructed from plans and specifications drawn up by architects. If each of these houses had been equipped to burn oil, at an average cost of $700, these home owners would have invested, in the aggregate, $77,000,000,—rather a large sum to be expended on the basis of the architects' recommendation of oil burners. As a matter of fact there were installed, during 1926, by 26 leading manufacturers, 77,000 burners, representing an aggregate cost of $64,000,000, and the business of 1927 probably was not far from 140,000 burners, worth $115,000,000. It is impossible to determine what proportion of the burners marketed last year was installed in new houses, but there is evidence that the architect is an important factor in this comparatively new field of endeavor.

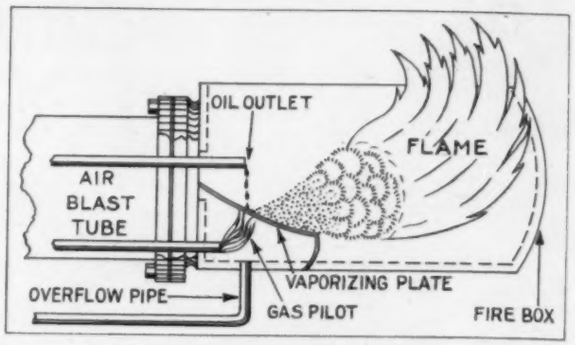
This summary does not take into account the simple and cheap atmospheric burners, directly gasifying the oil, and depending upon chimney draft for the air supply. Some burners of this type are really remarkable little devices. They burn light oils with comparatively high efficiency. They frankly are for the man of small means; require periodical cleaning; usually are manually controlled, and are not suited to anything but smaller houses. Many of these devices, however, are little more than smudge-pots, and are manufactured and marketed by men with little or no knowledge of the science of oil combustion; they consist of a few rough or semi-finished castings, and are sold for cash, with no thought of service or possibility of comeback. The atmospheric burner has had its genesis and its greatest distribution throughout the oil-producing section of the southwest, where oil is cheap and where not infrequently the home owner burns oil from his own well. It is not an important factor, outside of the oil-producing areas, and is seldom considered by an architect.

The Modern Automatic Mechanical-draft Burner. The domestic oil-burner type of today uses an electric motor varying from 1/10 to ¼ h. p., to drive a blower or fan which furnishes air for combustion at a definite rate. Usually the motor also drives a pump that draws oil from the storage tank and delivers it to the burner at a rate that gives the best heat-transfer results with the boiler or furnace in which the burner is installed. One mark of a first class burner is its ability to control accurately the flow of oil and air in an unvarying ratio, exactly as determined by the expert who adjusts the burner when it has been installed. The typical burner of the present time is characterized by intermittent operation; perhaps, from the standpoint of the home owner, it is more to be desired than the constantly functioning burner, although, with all its super-human automatic starting and stopping, under the guidance of a thermostat located in a distant part of the house, it is a moot question whether it is the more desirable from a technical standpoint.

Every Oil-burner Installation a Problem in Heating Engineering. One of the greatest mistakes that have characterized the merchandising plans of more than one manufacturer has been the belief that selling oil burners is just like selling anything else,—merely merchandising a commodity. The truth of the matter is that heating plants in homes, office buildings, hotels and schools should be, and nearly always are, engineering projects. Consequently, the installation of a highly specialized device for burning liquid fuel adds an engineering problem that must be worked out on the basis of what has already been designed and put in. An appreciation of this fact must precede oil-burner development, as trouble invariably will follow its disregard. An



Fire Pot Type of Burner in Which Air Blast and Oil Blast Enter the Fire Pot from Opposite Sides



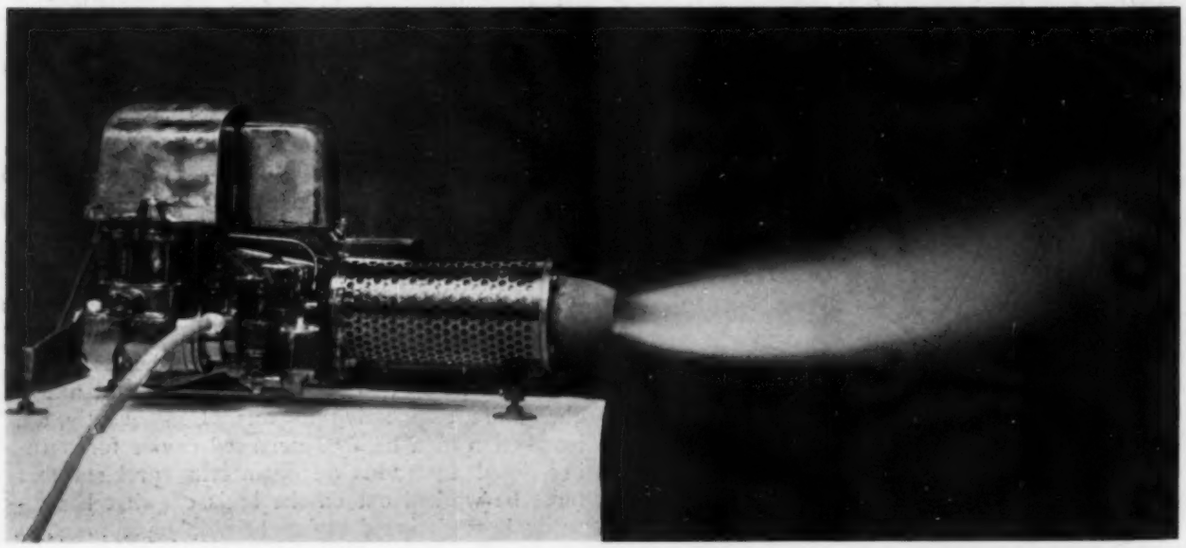
Vaporizing Pot Type in Which Oil is Directly Gasified on Drip from the Open End of a Pipe

oil burner certainly cannot be considered adapted to any and every heating plant; neither can it be hailed as a panacea for sick heating plants that have not given satisfaction. It is probable that no small portion of the sales resistance that has been encountered in the past has been due to over-enthusiasm on the part of agents, nearly all selling on a commission basis, and eager to promise anything to get the signature on the dotted line.

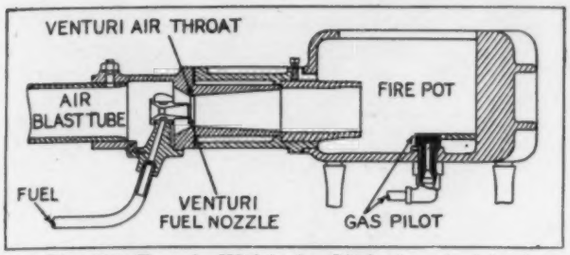
First Principles of Oil Combustion. In the first place, the so-called oil burner does not literally burn oil, as such, at all. Oil sold for domestic heating, like gasolene, is a hydrocarbon, derived from crude oil by the process of distillation, and it will not burn until changed into gaseous form and mixed with air. The carburetor of an automobile performs this function of gasification by drawing air through or over gasolene. The oils used for domestic fuels are much more difficult to change into gas, and frequently require heroic treatment. Consequently, the oil burner is, first of all, a mechanism for converting liquid hydrocarbon into gaseous hydrocarbon. This gaseous hydrocarbon differs, in one essential, from the manufactured gas that is so rapidly developing as a house-heating fuel,—it is not "stable" at ordinary temperatures, and unless maintained in a heated state quickly reverts to liquid form. So it must be made only at the rate at which it is required. In the intermittent type of burner the mechanism is dormant as long as the temperature in the house remains above the point at which the thermostat is set. When the house cools one or two degrees below that point, the operation of the thermostat causes the burner to begin to make oil-gas at a definite and predetermined rate, and to ignite this gas in the combustion chamber or firepot of the boiler or furnace.

The rate of combustion usually is such that the boiler operates at or near its point of highest efficiency. When sufficient heat has been developed to bring the temperature in the building back to one or two degrees above the desired point, the thermostat again acts, this time to stop the production of gas; consequently, the production of heat halts until the temperature again drops. So the burner "floats" intermittently, producing heat to match the more or less steady loss of heat from the building.

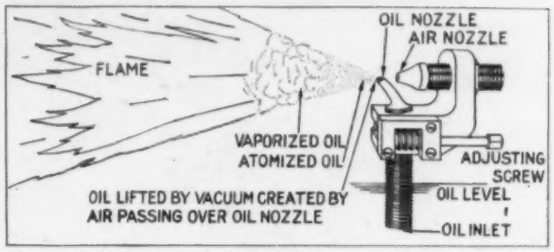
Gas-making and Combustion Are Automatically Initiated. There are, then, two essential functions of this type of burner,—the production of a gas-



A Burner in Which Combustion is Initiated and Practically Completed in a Combustion Tube



A Fire Pot Type in Which the Oil is Atomized in the Throat of a Venturi Nozzle



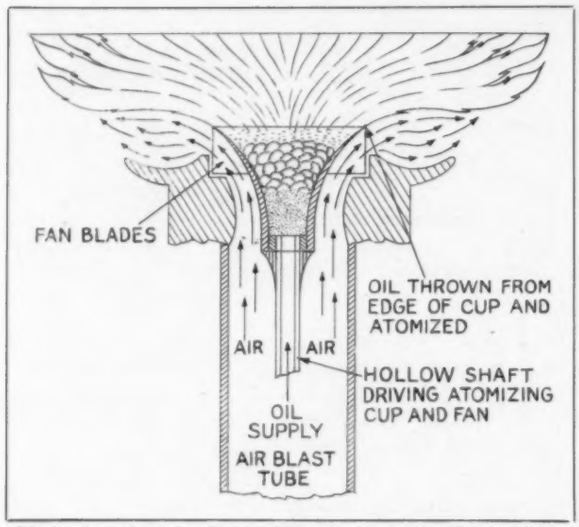
Atomizing Device Similar to Dressing Table Atomizer in Principle

air mixture, and its automatic ignition. Now there is only one way that oil can be changed into gas, and that is through heating it. Atomizing the oil or breaking it up into minute globules is merely a preparatory step, vastly increasing the surface of a given quantity of oil. This increased surface allows heat to act more quickly on a given volume of oil than if it were in a single large sphere, or in a sheet, or even spread out in a thin film. When a burner of this type starts, ignition is accomplished through a hot electric spark or a gas-pilot flame. The heat from either of these gasifies the oil globules close to the point of ignition, and combustion almost instantaneously spreads through the entire jet of atomized oil. The radiant heat from the flame quickly heats the refractory lining of the combustion chamber, in whatever form it exists, and this heat is reflected back and performs a useful and necessary function in speeding up the gasification of the oil globules. It is highly important that none of these tiny drops of oil strike any part of the boiler walls, as they would quickly build up a film of soot, and soot is a most excellent insulator which would soon reduce the efficiency of the boiler as a heat-transfer device.

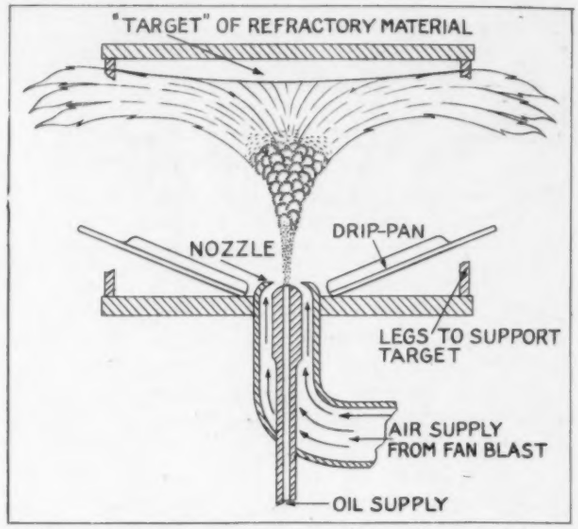
Air and Oil-gas Proportions Should be Definite. It is obvious that a prime function of the burner mechanism is to cause a definite amount of air to be introduced to the combustion chamber and there intimately mixed with the oil-gas. It is impossible for a burner to produce complete combustion if exactly the theoretically correct amount of air is admitted; there must be an excess over the theoretical amount required, but as was aptly said, "there must not be a *surplus* of excess air." Between 25 and 50 per cent excess air will be needed with most burners, although as much as 100 per cent must be used with burners of poor design. The metering devices, then, must be extremely accurate in measuring the amounts of air and of oil fed to the burner. When the burner is installed the setting should be made only on the basis of flue-gas analysis made with an Orsat apparatus. This will indicate the degree of combustion efficiency obtained, and the burner, once set at the optimum point, should not be disturbed. It is a pretty safe gamble that any manufacturer, or his representative, who insists on making an examination of the heating plant before definitely signing up for the burner, and who checks the efficiency of his burner by an actual flue-gas analysis, can be relied upon to deliver a satisfactory equipment.

Vital Features of Leading Burner Types. There are so many types and styles of burners that it

"Gun" Type Burner, Atomizing Oil by Throwing It from the Edge of a Rapidly Revolving Cup



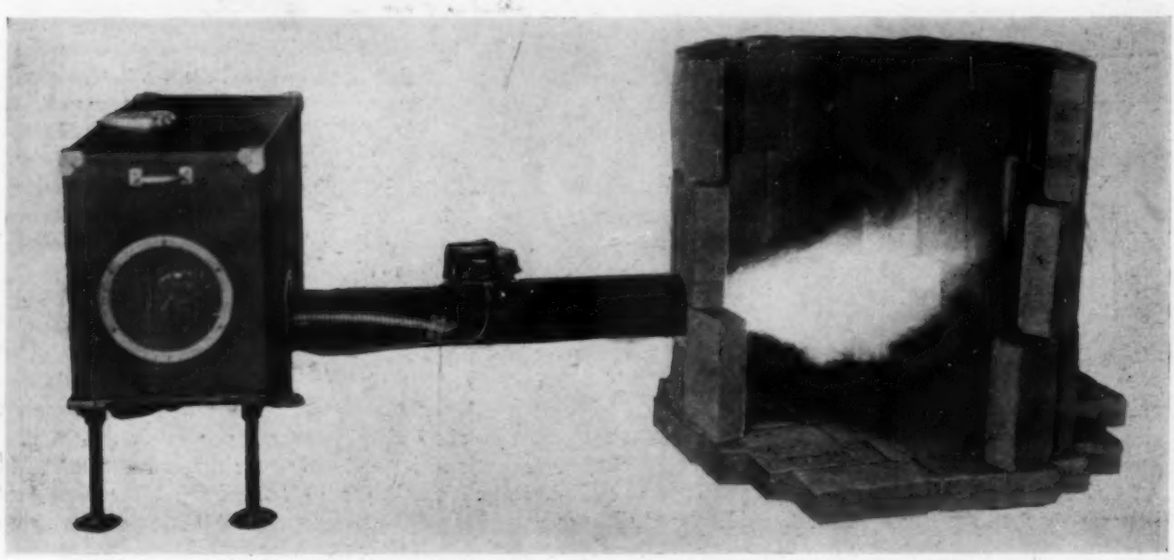
Oil is Atomized by Being Thrown from the Edge of the Vertical Chalice-Like Cup Which is Rapidly Rotated



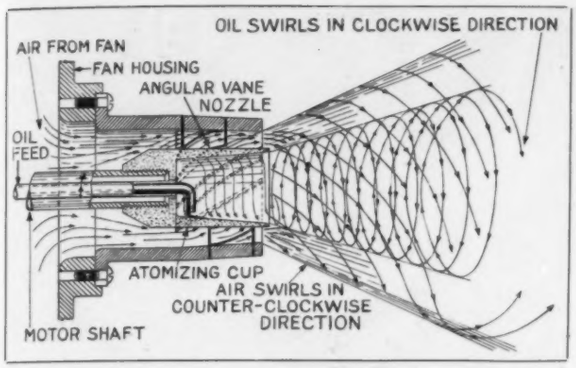
Oil is Atomized by a Nozzle, and the Flame is Directed Against a Refractory Target Above

is practically impossible to classify them in any completely satisfactory way; suffice it to mention the more important, and comment on their salient features. Two of the earliest types, dating back at least a quarter of a century, are "the rotating cup atomizer" and the "nozzle atomizer" using compressed air to break up the oil. The latter type followed the burners developed for navy use, but were better adapted to larger units than were required for domestic heating. The use of the rotating cup at the end of a horizontal shaft, atomizing oil by feeding it to the inside of the cup and throwing it from the sharp edge by centrifugal force, had its genesis on the Pacific coast, and had extended use long before oil was used as a domestic fuel east of the Mississippi River. This type has long been so well developed that at a recent exhibition of burners one manufacturer showed a 1917 model beside another of the 1927 vintage, and only careful examination of details showed any change. This type of burner has one distinct advantage in that it can be used with almost any fuel oil that can be burned. It produces a conically-shaped flame that can be flared, when installed in a wide firebox, and lengthened, when set in a long and deep boiler. One manufacturer ships from California to an eastern distributor by way of the Panama Canal. The tiny burners destined for Long Island homes are carried in steamers that are fired with huge burners of the same make.

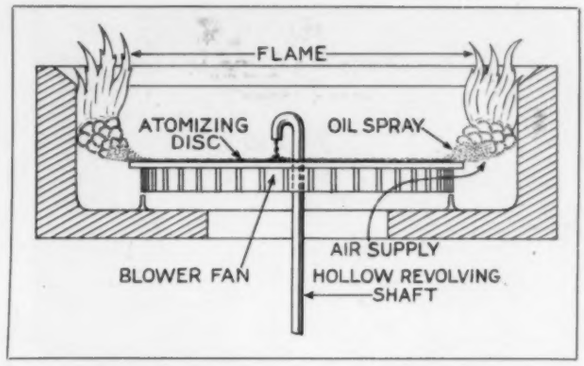
A later development of this type of burner provides for a vertical revolving cup set in the center of the chamber, at the grate level, and driven by a motor set outside of the boiler, the drive being through spiral gears. The cup, in this case, has a wide, flaring mouth, so that the oil is thrown



A Burner Typical of Several Makes, Atomizing Oil at One End of a Blast Tube



Oil Thrown from a Revolving Horizontal Cup Mixes with Counter-Revolving Air. This Produces a Flame Similar to that Shown at Bottom of Page 252



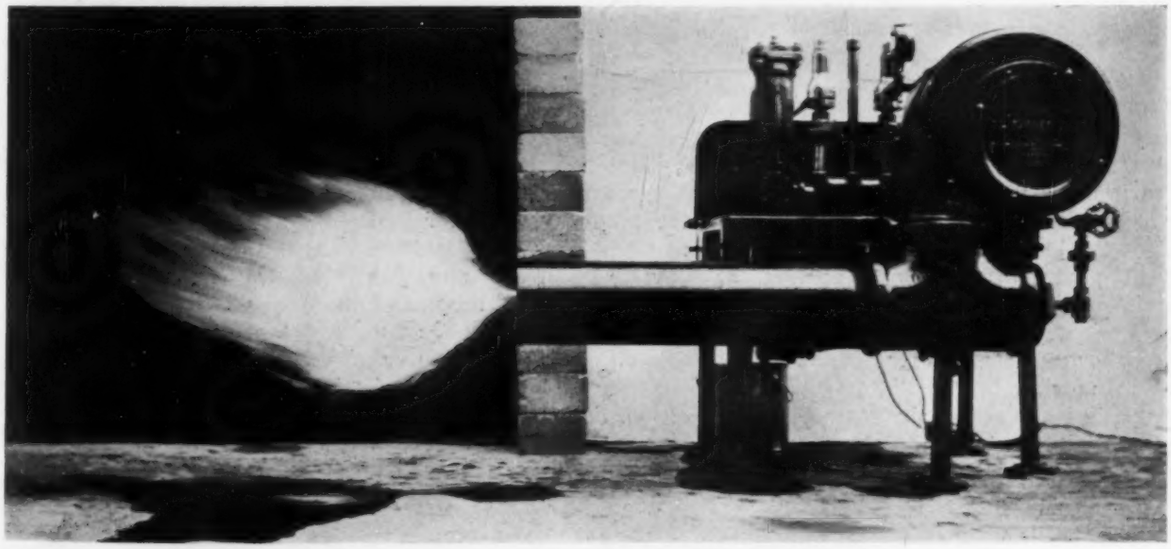
Oil Carried Through a Vertical Shaft is Delivered to a Revolving Horizontal Disc and Gasified by the Radiant Heat from the Surrounding Refractories

in an almost horizontal sheet. Another design flattens the cup to a revolving disc driven in the same manner and handling the oil in the same way. Several small burners use modified discs or cups, but the drive is direct from a motor placed vertically in the ashpit.

The "Gun" Type. Then there is the "gun" type burner, in which an air blast is carried in a horizontal tube set with its end projecting into the lower part of the boiler, usually through the ash-door frame. In this tube is a rotating cup driven by a set of vanes on its outer surface, against which the air blast acts. Oil is fed into the cup through a hollow shaft, and is atomized by being thrown from its periphery. Again, this type follows the huge burners developed to use heavy oils in large boilers. Another well developed burner utilizes the simple principle of the dressing table atomizer. A small vertical tube is set with its lower end dipping into a sump containing oil maintained at a fixed level. The air blast directed across the upper end of the tube draws oil from the sump and atomizes it by the force of the blast.

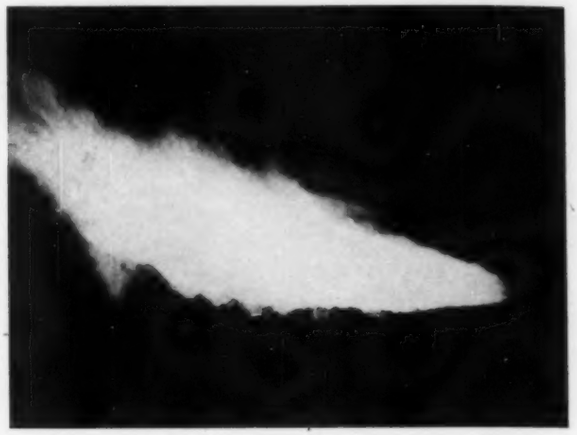
Developed for the Steam Car,—Now Leading Domestic Burners. Distinctive types of burners for domestic heating were the offspring of burners first developed for use in steam automobiles. These were the first types to be automatically started by a thermostat, and the idea of dispensing with manual attention and having the burner started through the action of the thermostat, and intermittent in operation, has generally been "sold" to the American public. From one of these types has sprung the "combustion-pot" burner, in which combustion is initiated and partially completed in a metallic pot, sometimes lined with refractory material, the pot taking the place of the bricked-in combustion chamber. Yet another type of burner brings about atomization by forcing the oil through a small orifice, or by drawing it through the throat of a Venturi tube,—a passage having a restricted section forming a neck. The ingenuity of American engineers has produced an almost incredible number of modifications of the various essentials of burner design.

The Controls Are Really Super-human. Probably the most fascinating phase of oil-burner his-



A Blast Tube Burner Made up Largely of Usual Commercial Fittings and Parts

The Extended Flame of a Pot Type Burner Using Flue Gases to Slow Down and Quiet Combustion



Flame Produced by an "Atomizer Type" of Burner Similar to that Shown in One of the Diagrams on Page 251

tory has been the development of the controls by which the burner's functioning is governed. Assume that it is required to start a burner, where a small gas flame is maintained as a pilot, and where this flame is expanded to produce a large hot flame that will insure ignition. Oil is to be atomized by forcing it through a hole in a nozzle. Also it is desired to safeguard the operation, so that if for any reason ignition is not accomplished, the burner will not continue in operation, squirting raw oil into the combustion chamber. A tiny electric motor drives, through a train of gears, a slowly revolving plate of bakelite, into which are moulded circular arcs of copper. Bronze fingers rest on the disc in such a way as to complete electrical circuits through the metallic portions. The living room, in which the thermostat is located, grows colder than the temperature at which the thermostat is set. The contraction of the thermostatic element closes the circuit to the little motor, and it starts rotating the slowly moving disc. A finger makes a contact, and the burner motor starts, building up air pressure with the blower and oil pressure with the oil pump. At the same instant another circuit is closed, opening a magnetic gas valve and causing the small pilot flame to expand. By this time the oil pressure has built up to the required degree, and the oil nozzle opens. The atomized oil is blown into the gas flame, gasified by its heat, and the combustion reaction between the oil-gas and the air from the blower is initiated. When sufficient time has elapsed to provide for the ignition, the gas valve is automatically closed and the gas flame dies down to a minute pilot, consuming very little gas. Suppose, however, that combustion had not been brought about, possibly because the gas pilot had been extinguished or because the gas supply had been cut off. An interlocking control is located in the stack, and unless this is heated to a definite minimum temperature in a definite number of seconds after the burner motor starts, it acts to shut down the entire burner, and it cannot again be started until the trouble has been remedied, thus insuring safety.

Of course this control device must go through a definite cycle; each operation must be in its proper order and with definite timing. Therefore, human ability has been transcended in its design, and if something should happen to stop the control device before it has completed its cycle for starting the burner, such as an interruption to the electric service, the control on the resumption of service would immediately move to the starting point of the cycle and go through a complete program to put the burner in operation properly.

Protection Against Human Error. Again, there has been provided a safeguard against the home owner who likes to "air out" the house. If the windows of the room in which the thermostat is located are left open for any length of time, the thermostat will start the burner, and it will continue to generate heat in the boiler with no chance of the thermostat's shutting off the burner, because the room cannot be warmed up with the windows open. Under such conditions it might easily be possible for the burner to generate enough heat to lower the water line in the boiler and cause serious damage. But a little safety device, located just inside of the boiler wall, is interlocked with the burner control, so that as soon as the water or steam rises to a definite temperature, the burner is shut off, regardless of the fact that the thermostat may be calling for heat. In this way the owner of a burner is protected even from his own carelessness, and it is no wonder that with such operation and control, the use of fluid fuels is rapidly spreading throughout the United States.

The April issue of THE ARCHITECTURAL FORUM will set forth in detail the usual clients' questions, and will give specific information on which the architect may rely in giving answers to his clients, who so often depend entirely on his counsel in the matter.

Editor's Note. Diagrammatic illustrations used through the courtesy of Good Housekeeping Institute.

THE DEEPEST FOUNDATIONS

BY
FRANK W. SKINNER
CONSULTING ENGINEER

THE efficiency of the great industrial furnaces now in use made possible column loads that necessitated footings below a deep stratum of treacherous clay underlying the Cleveland Union Terminal Building. The tallest of subterranean piers were built there in open wells safely excavated far beyond previous foundation limits notwithstanding increasing dangers of crushing, flooding, fire and explosion, 260 feet below the surface. Not until about the beginning of the present century were there developed the great furnaces that can properly heat huge steel ingots. Not until these great 10-ton castings could be heated almost white-hot was there perfected the structural steel that alone makes possible the metropolitan skyscraper. Not until buildings towered to heights of from 20 to 50 stories did their column loads produce such enormous concentrations of weight on the foundation piers that nothing short of solid rock bearings is satisfactory footing for them.

In the public square in Cleveland, where the

Cleveland Union Station
Graham, Anderson, Probst & White, Architects

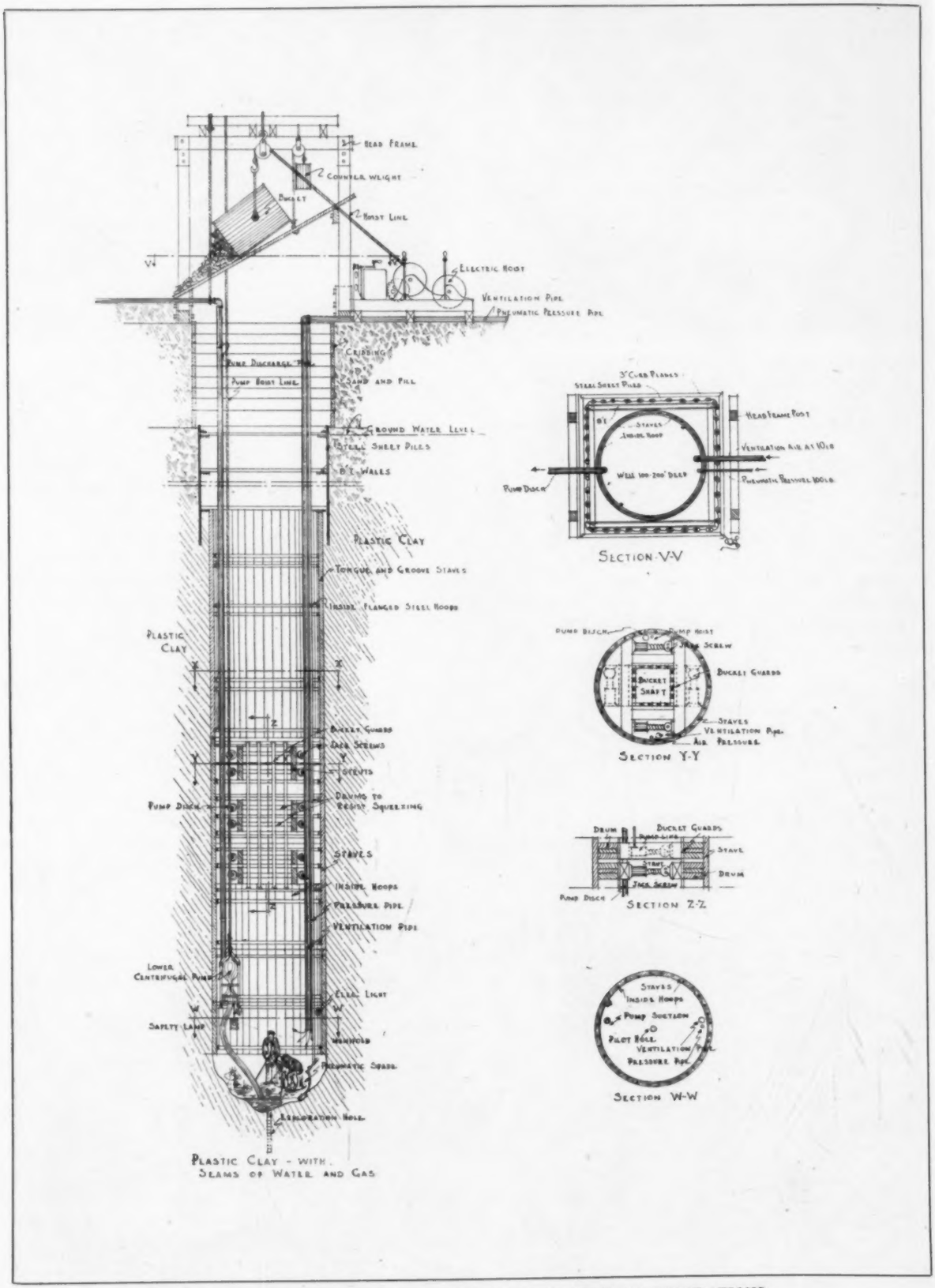


DIAGRAM SHOWING METHOD OF SINKING THE DEEPEST FOUNDATIONS

CLEVELAND UNION STATION

GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

$11,000,000, 52-story Union Terminal Building rises to a height of 708 feet above the street, bedrock is more than 250 feet below the surface, and to carry the foundation to it there was required much deeper excavating than has ever been done for building foundations,—deeper indeed than the deepest of open dredged caissons, more than the penetration of the longest piles that have determined previous maximums, and far deeper than the utmost limits of pneumatic caisson work below water levels which have measured, in millions of dollars, the cost of many of the great New York buildings, where it was necessary to pass through no more dangerous quicksand to reach the rock only 100 feet below the earth's surface. The conditions were somewhat similar to those in Chicago, but far more difficult and dangerous in that the required depth in Chicago is much less, and the deadly methane gas is not encountered. The safe, rapid, and economical construction of the 87 main foundation piers of the Union Terminal Building is therefore an achievement of the first magnitude, of high importance to the architectural profession, that was accomplished by the vision and courage of the designer, supplemented by the ability of the builders and the skillful use of the best standard methods and equipment, all ably coördinated.

The great building, facing two sides of the public square and covering a 260 by 300-foot irregular area of more than 71,000 square feet, provides 560,000 square feet of rentable floor space in its 120 by 120-foot tower and in the remainder of the structure extending two stories below street level. Its 17,000-ton steel superstructure is supported on 87 very deep and slender concrete piers from 4 to 10½ feet in diameter that extend to a maximum depth of 210 feet below the bottom of the general excavation, itself 52 feet deep. The excavation to subgrade of the great basement pit, drained to half-mile ditch by four pumps that with their motors were movable on small trucks, required the removal of many thousand yards of earth, handled by steam shovels that later were used to load the 20,000 yards of muck from the deep foundation pits and to handle the steam hammers with which hundreds of tons of sheet piles were driven to line the upper parts of these pits.

When the excavation reached the surface of the great bed of water- and gas-bearing plastic clay, a particularly highly developed system of excavation was adopted; numerous small but powerful and rapidly working spades cut away the tough clay, leaving the smooth vertical sides of the circular wells, which were immediately covered with 4- and 6-foot vertical tongue and groove wooden staves forming short, complete cylindrical sections held in place by inside top and bottom steel rings. Section after section of this lining was built, from the top downward, as the excavating progressed, and after the clay had been exposed to the atmosphere it gradually began to swell, exerting sometimes such a powerful squeeze that it was necessary to brace the sides of the wells with many adjustable horizontal diaphragms having

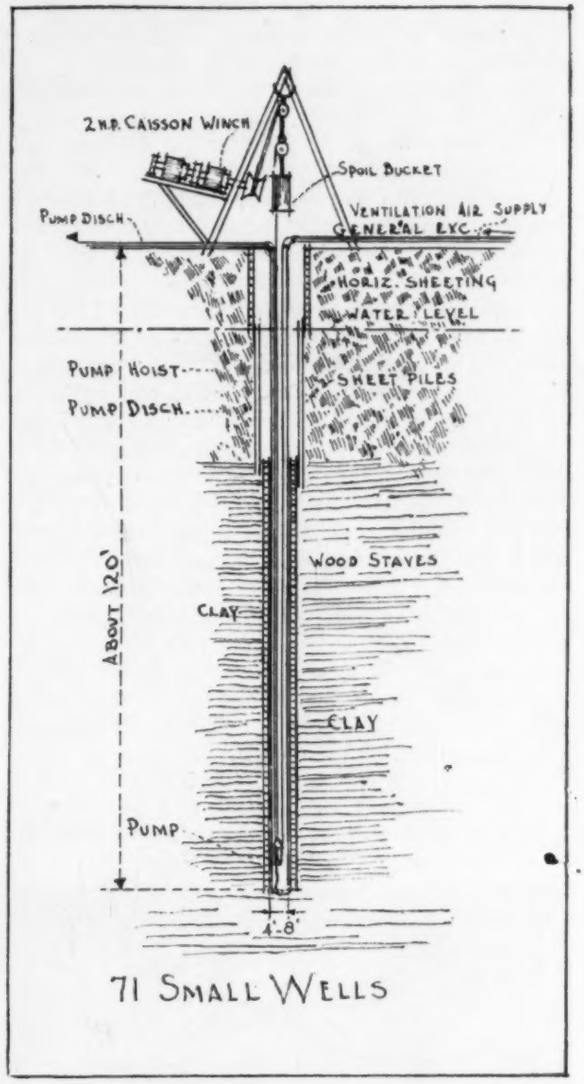


Diagram Showing the Method of Sinking the Small Wells

pairs of powerful jackscrews frequently operated to maintain the required diameters of the shafts.

Great quantities of water, flowing through seams in the clay, threatened to drown out the workmen, and were removed by powerful centrifugal pumps which, mounted with their 16-horse power electric motors in narrow frames, were suspended in the wells and were capable of delivering 200 gallons per minute to a height of more than 100 feet. At depths of more than 100 feet the first pump remained stationary while a duplicate was lowered successively to the bottom of the well and discharged into its section pipe so that the upper pump acted as a booster and was able to deliver to the bottom of the general excavation, where its discharge was disposed of to a drainage ditch. The 20,000 yards of muck, excavated by the handful, was hoisted from the wells in cylindrical buckets operated by 26 electrical hoists of from 2 to 20 horse power, raising it at a speed

of from 100 to 130 feet per minute, the same muck buckets serving for the ordinary ascent and descent of from one to four workmen in each well.

Most insidious and dangerous of all the difficulties encountered was the heavy flow of methane gas that entered the wells at a depth of 190 feet or more below the surface and which, although colorless, odorless and tasteless, was detected both by observation of its bubbles, rising through water that filled the 3-inch pilot holes driven in advance of the general excavation, and by the action of the safety lamps that flickered when a very small quantity of the gas was present and that were automatically extinguished before it accumulated sufficiently to be dangerous. This gas, which is poisonous, inflammable and explosive, has for many years been encountered in the same stratum in Cleveland, where on former occasions it has cost many lives. The contractors were therefore forewarned and safely disposed of the gas by the installation of a 1000-foot blower that poured large quantities of pure air at 10-pound pressure into the bottoms of the wells, thus diluting and sweeping out the gas, an operation that was supplemented by the exhaust of high-pressure air from the pneumatic spades and by the almost continual motion of the large buckets passing up and down in the narrow wells. Notwithstanding all of these precautions, even after the gas had been removed from one of the wells, the quantity was so great that before it was dissipated in the general excavation it was ignited by an accidental spark and burned a number of workmen.

The smallest wells were carried to a depth of about only 100 feet, where they terminated in a hard stratum of the clay; 16 of the largest wells were carried down to bedrock, which was dressed down to a depth of 8 or 10 feet to prove its soundness and thickness. When satisfactory bottom was reached, the wells were fixed with solid masses of concrete mixed at a maximum rate of 750 yards per 24-hour day in a machine operated by an engine and discharging 1-yard batches of concrete to the distributing system, which consisted of a 240-foot steel tower in which the concrete bucket was hoisted and delivered to several hundred feet of steel chutes, supported on counter-weighted suspended trusses, and hung from a high line cable. This flexible system, commanding every part of the general excavation, delivered not only to all of the wells but also to the forms for the massive concrete retaining wall that protected the high sides of the pit.

Notwithstanding the installation of the abundant mechanical equipment, the experienced subway and foundation builders of New York who were the contractors for the substructure employed a force of about 250 men that, most of them working continuously in three 7½-hour shifts per day, completed these foundations and also some minor foundations, constructed with 54 steel piles, 16 inches in diameter and from 20 to 30 feet deep, in about nine months at a cost of $500,000, which compares favorably with the cost of many foundations of not one-half this depth, an achievement of no mean size.

Square and Tripod Head Frames Over Many Wells for the Foundations

CONCEALING THE RADIATOR

BY

ROBINSON V. FROST, C.E.

FROM the first there has been a persistent effort to get radiators out of sight. The radiator has never been able to supersede the fireplace or even the parlor stove as a focal point for the home circle, for as yet we have been unable to invest it with a personality; hence, while we recognize its usefulness we cannot accept it on that ground as a member of the family circle. Likewise it has failed to gain acceptance as an article of furniture, or even as a part of the decorative treatment. As the latter it has most insistently demanded recognition,— first as an ornate piece of art, highly embellished with supposedly artistic designs, and then, as the manufacturers recognized the trend of public sentiment, with the lines simplified, until today we have the slender tube type of radiator in which the straight line and plain surface are emphasized. Notwithstanding the appearance of the more clean-cut and dignified design that more easily harmonizes with its surroundings, the practice of concealing the radiator has grown with such strides that today the development of the concealed type of radiator is looked upon as the next step in the progress of the science of heating.

While the concealed type of radiator is rapidly becoming important, we cannot speak of it as having "arrived" commercially, for the development of those types of radiators designed specially for concealment is in a state of flux, and the sale of such radiators is still but a small part of the total production. The other phases of concealed radiator practice, those of building in recesses or using enclosures as parts of the architectural treatment for the partial or complete concealment of the cast iron type of radiator, have grown with enormous strides. To this practice may be attributed not only the rapidly growing development of the type of radiator designed especially for concealment, but also the development of the portable type of enclosure or cabinet now sold by furniture, hardware and department stores. But probably the greatest increase is in the number of radiators that are enclosed as parts of the building construction. One hardly realizes the demand that exists at the present time for this type of enclosure. The only indication that we have of the extent of this demand is in observing the great variety and the great frequency of these installations. In the finer type of residences, in office buildings, and in public buildings of every description where architectural beauty has been featured,—churches, theaters, auditoriums, art galleries, libraries, college buildings, hotels, clubs, restaurants, stores, banks, railroad stations and the like,—one can see every day installations of direct cast iron radiators concealed in built-in enclosures.

Of course these installations are made where first cost is not the primary consideration and where there is a demand for beauty and harmony rather than for bare utilitarian requirement, for one who conceals the radiators faces not only the additional cost of enclosure, which is frequently higher than the cost of the installed radiator, but also faces the probability that he will be required to install at least 25 per cent more radiation to give the required capacity. Consequently, the concealed radiator presents a problem that requires the attention of the architect, for installations that do not require his supervision are very infrequent. The architects deserve full credit for this movement, which is now looked upon

Improving Appearance Is the Usual Motive for Concealing the Radiator

A Concealed Radiator Installation That Has Proved Efficient as Well as Sightly
Harry Gordon McMurtrie, Architect

as likely to become one of revolutionary character to the entire heating industry, for it was they who first voiced the demand for concealment of the radiator, and it is they who have continued to insist upon it.

"Condensation" and "Heating Effect." Until recent years it had generally been assumed that the performance of a radiator was entirely dependent upon the rate of condensation, and that the measurement of condensation formed a complete index of the rate of heat transfer. Now we know that there are other factors that have a most important bearing upon the rate of heat transfer or, more properly speaking, upon the "heating effect" of the radiator. The term "heating effect" as applied to a radiator is new in heating nomenclature, it being used to distinguish between the useful heat derived from the radiator and the heat input as measured by condensation. In making this distinction there are difficulties, for at present we have no definite means of measuring this quality of heat transfer. It is this quality we have seen fit to designate as "heating effect," which may receive more attention in the heating industry. While concealing the radiator had its beginning in an endeavor to hide unsightly utility, it has grown into an important phase of the science. We have observed on numerous occasions that when a cast iron direct radiator is enclosed in a casing or cabinet of certain definite proportions, we seem to get very much more heat out of it than we do when it is exposed; but when we measured the condensation from the enclosed radiator we found that the condensation was much less than that from the same radiator when exposed without the enclosure. At first we had no reasonable explanation for this seemingly impossible condition, until we began to make observations of the temperatures in the room at various heights from floor to ceiling. Then we found that whereas the temperature difference between floor and ceiling was about 15 degrees with the direct radiator, when the same radiator was enclosed it was about 5 degrees.

Properly concealed radiators may save fuel, increase comfort and improve health. It has long been a frequent complaint against radiator heating that the rooms were either underheated or overheated, but few of us realized that that impression was due very largely to our positions in the rooms, whether standing or sitting. It has always been the custom to measure the temperature of a room at a level of about 5 feet above the floor, which we call "breathing line height," and if we maintained a temperature of 70° at that level, we assumed that the room was properly heated. But how many ever took the trouble to hang a thermometer at the floor level and another at the ceiling? Would it not be a great surprise to find a temperature of 62° at the floor level and a temperature of 77° at the ceiling? This temperature difference at different levels may be the source of our ideas of overheating or underheating. A child playing on the floor may be in a temperature of 63°, while a tall man standing erect may have his head in a temperature of 72° or 73°. But when he sits down he may drop into a temperature of 67°. If you passed from a room heated at 70° into another heated to but 65°, you would have an immediate sense of discomfort, particularly with the low humidity usually existing in heated rooms in winter. Yet the condition exists in most houses heated with the ordinary radiator. The nature of the seemingly greater "heating effect" of enclosed radiators cannot be completely explained at present, but it is generally assumed that the enclosure about the radiator pro-

A Shallow Wall Cabinet Which Is Made a Part of the Decorative Treatment

duces a more rapid circulation of air over the radiator surfaces, and this action in turn induces a more thorough circulation of the air in the room, thus preventing the stratification of hot air at the ceiling that exists with the direct radiator. However, this action may be but one of several of a varied nature that have a bearing upon the result.

With the growth of the practice of concealing the radiator, new types have been designed especially for the purpose. The so-called "fin" type, of which there are now a dozen or more on the market, has many desirable features as a concealed heating unit. This type possesses a number of metal fins that add radiating surface to some form of prime surface of tubular or more intricate shape. It has as its essential feature, simplicity, lightness, compactness. While the selling price of these units is now somewhat above that of the corresponding capacity in cast iron, it may be expected to drop as selling volume increases and production costs decrease. Although the trend seems to be toward a new type of heating unit for concealed radiator installation, the usual cast iron radiator is employed with excellent results.

Principles of Enclosure Construction. If certain definite rules are followed in the construction of the enclosure, not only may the heating effect be measurably increased but there may be a marked saving in fuel as well. It is very easy in the construction of the cabinet or enclosure to nullify all the economic value to be derived from an enclosure, and there are many installations of concealed radiators that injure rather than improve the heating effect,—though they may achieve their purposes of decorative effect. The features of correct design are indicated in the diagram shown on page 262. Each of these features is important, and the alteration of any one may nullify the effect of all. Determining these features is the development of years of observation. Research extended over a period of six months and was fully reported in a paper under the title "Some Facts about Enclosed Radiation" presented before the 31st annual meeting of the American Society of Heating and Ventilating Engineers. Within the past year research on radiator enclosures has been undertaken by the Engineering Experiment Station of the University of Illinois, reported in Bulletin 169 under the title, "Effect of Enclosures on Direct Steam Radiator Performance" by Maurice K. Fahnestock, but the latter research differs from the writer's in that heating effect was not considered, only condensation from the radiator being taken into account. In this regard the research was very thorough, and it is now understood that the University has additional equipment that will enable it to study heating effect as well as condensation. In the research so far completed, the data compiled agree very closely with the writer's. The only other research of record which is of value as a check is that of Dr. Charles Brabbee, conducted while he was at the University of Berlin-Charlottenburg in about the year 1908. In Dr. Brabbee's work, like that at the University of Illinois, only condensation was considered.

The Cast Iron Radiators Are Successfully Concealed in St. Paul's Church, Chestnut Hill, Pa.
Zantzinger, Borie & Medary, Architects

The Radiator Takes Up No Floor Space in This Bedroom

A cast iron radiator concealed after the manner shown in one illustration on page 260 has many desirable features and can be used effectively except in thin walls. These principles as applied to a cast iron radiator are very well shown in the illustration just mentioned. This installation, in a club dining room, by Harry Gordon McMurtrie, architect, proved so successful that this is the most easily heated room in the building, although the ceiling height is over 20 feet and there are full height windows.

Many types of radiator enclosures are available,

varying from the simple deflector over the top of the radiator through the different types to those having humidifying pans and elaborate grilles. It has generally been thought that there should be at least 2 inches clearance between radiator and the inner surface of the enclosure, but this has been disproved, as better results are obtained by placing the inner surface of the enclosure in direct contact with the front and back of the radiator. This is particularly true in the use of the new tube type radiators with their larger clearance.

A very attractive concealed radiator installation, although not making full use of the heating surface, is illustrated from a design by Zantzinger, Borie & Medary, architects (page 261). A cast iron radiator, concealed in an enclosure, not only lends itself to more harmonious decorative treatment, but the improved economy and health derived may be considered reasons for the added expense of enclosure in any type of installation. Indeed these latter reasons may be the controlling factors by which the practice of concealing radiators will become well nigh universal. The development along these lines will probably be in producing small, light and inexpensive radiators especially for this purpose. Today, however, an architect contemplating the use of one of the new fin type radiators has several points to carefully consider before selecting any one type because of the wide variation in design and rated capacity. There is a lack of standardization, which of course prevents the use of one manufacturer's fitting in place of that of another, and therefore one particular make must be selected and provided for in the heating layout. In making this choice the architect must therefore carefully weigh the different factors of strength, durability, ease of cleaning dust from the unit, probable life, space comparisons, safe ratings, etc. To illustrate the wide variation in ratings we can make a comparison on the item of space required. Three units, designed for concealing in the wall, are each 36 inches long, approximately 3½ inches deep, and rated for a casing 35 inches high, but variously rated at 39, 37 and 27 square feet equivalent direct radiation, two nearly 50 per cent greater than that of the other. Two others, having the dimensions mentioned but approximately 7 inches deep, are rated at 55 and 42 square feet respectively. Three other radiators designed for cabinet installations are approximately 55 inches long, 9 inches deep and 38 inches high to top of cabinet. One is rated at 55 feet, the second at 70 feet, and the third at 101 feet, while a cast iron direct radiator of the same space dimension is rated at 110 square feet. The architect, therefore, has quite a problem before him in selecting the best design for his purpose. Undoubtedly, before many years, this wide difference in ratings will have been eliminated, for the existing condition has decided disadvantages to both the house owner and the manufacturer.

Heating effect and æsthetic effect do not always go hand in hand, but the newer developments in concealing the radiator have demonstrated that they are not essentially antagonistic factors. It is possible to combine attractiveness with efficiency in the heating equipment, and great strides are now being made in this direction.

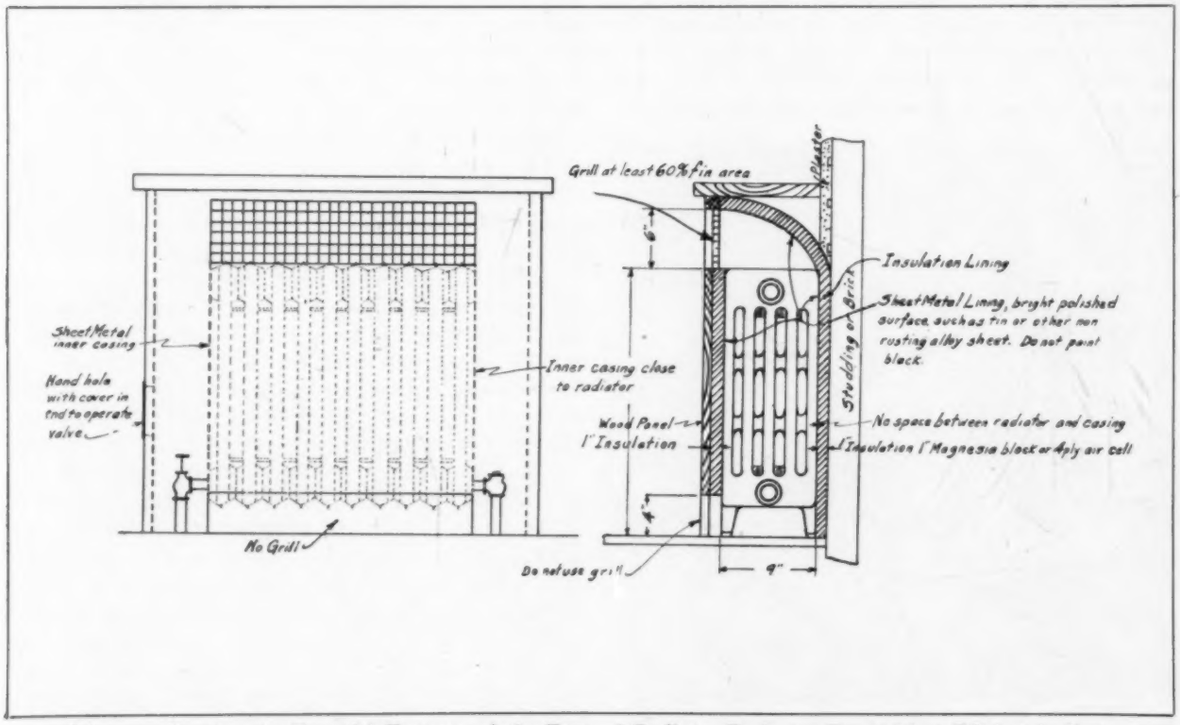

Grill at least 60% fin area
Plaster
6"
Insulation Lining
Sheet Metal Lining, bright polished surface, such as tin or other non rusting alloy sheet. Do not paint black.
Studding or brick
Sheet Metal inner casing
Hand hole with cover in end to operate valve
Inner casing close to radiator
Wood Panel
1" Insulation
No space between radiator and casing
1" Insulation 1" Magnesia block or 4ply air cell
No Grill
Do not use grill
9"

Diagram Showing the Essential Features of the Type of Radiator Enclosure Found Most Efficient in Tests Conducted by the Author

ECONOMY IN SMALL HOUSE CONSTRUCTION

BY
A. G. HILLBERG
PRESIDENT, MIDHAMPTONS HOMES CORPORATION

SPECULATIVE small house construction offers a wide field for the builder, but the architect seldom has an opportunity of aiding in this work. This might be because a builder, erecting houses as a speculation and anxious to produce them at as low a cost as possible, will create designs based on use of stock millwork, stock trim, short spans, etc., to gain his objective. He is rather afraid of the architect with his artistic tendencies that may lead to higher costs because of drawings calling for expensive or difficult work. The disastrous results of the builder's activity in the architectural field of designing are clearly shown in our suburbs, where the mass production of ugly, standardized types of houses standing side by side in symmetrical rows is altogether too common. Practically the only favorable comment that can be made about such houses is that the prices asked are surprisingly low, which is made possible only through strict standardization of every detail of the building project. Consequently, when architects do undertake the work of designing small houses for mass production, they should contrive to produce a plan offering sufficient variety in the arrangement of the rooms to permit alteration of the shape of the dwelling through rearranging standard room units without interfering with the standardization of the details of construction.

A solution of this problem can be obtained, as is shown in Fig. 1, where the living room, kitchen, and bath, forming the main unit, have been so laid out that the fireplace, boiler and kitchen flues are placed together and are in one most economical interior chimney. Interior chimneys are obviously the cheapest. The kitchen and bathroom fixtures occupy opposite sides of the same interior partition, which reduces the plumbing system to its simplest and cheapest form. The bedrooms and an eventual dining room, all of standardized dimensions, can be grouped around such a main unit, as is shown by the dotted lines. Should an angular plan be desired, the rooms could be grouped as shown in dot and dash lines. Should more bedrooms be required, the unit indicated in Fig. 2 could be used to replace the corresponding bedroom unit shown in Fig. 1. By using floor plans such as those indicated, the shape of the house could be altered without interfering with the strict standardization of the details entering into the construction, and by placing the houses irregularly on their respective plots, the monotony could be relieved and a more pleasing appearance obtained than if a symmetrical arrangement were adopted.

When designing the shapes of the various rooms, it should be borne in mind that the floor systems must be supported in the simplest way and that it is not economical to run the joists in different directions in adjacent rooms, even if somewhat shorter spans could thus be obtained. The building should be so designed that all joists in the same floor system run parallel. Inasmuch as lumber comes in lengths which are multiples of even feet, the room dimension running parallel to the joists should also

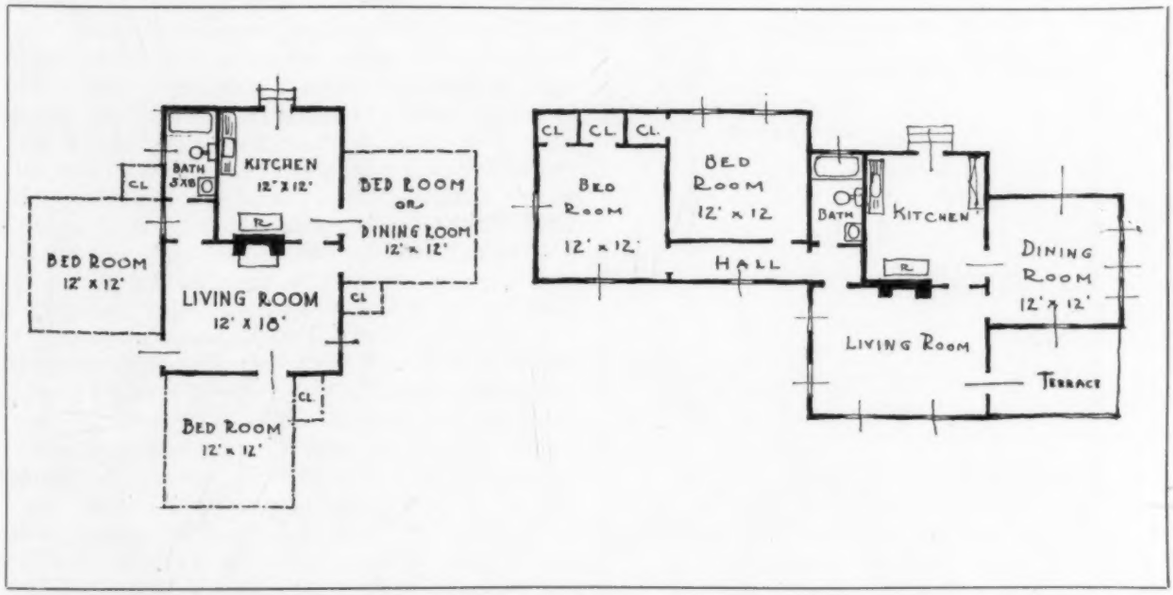


Fig. 1. Plan of Standard Units Showing Several Possible Variations

Fig. 2. Interesting Plan Developed From Same Units Shown at Left

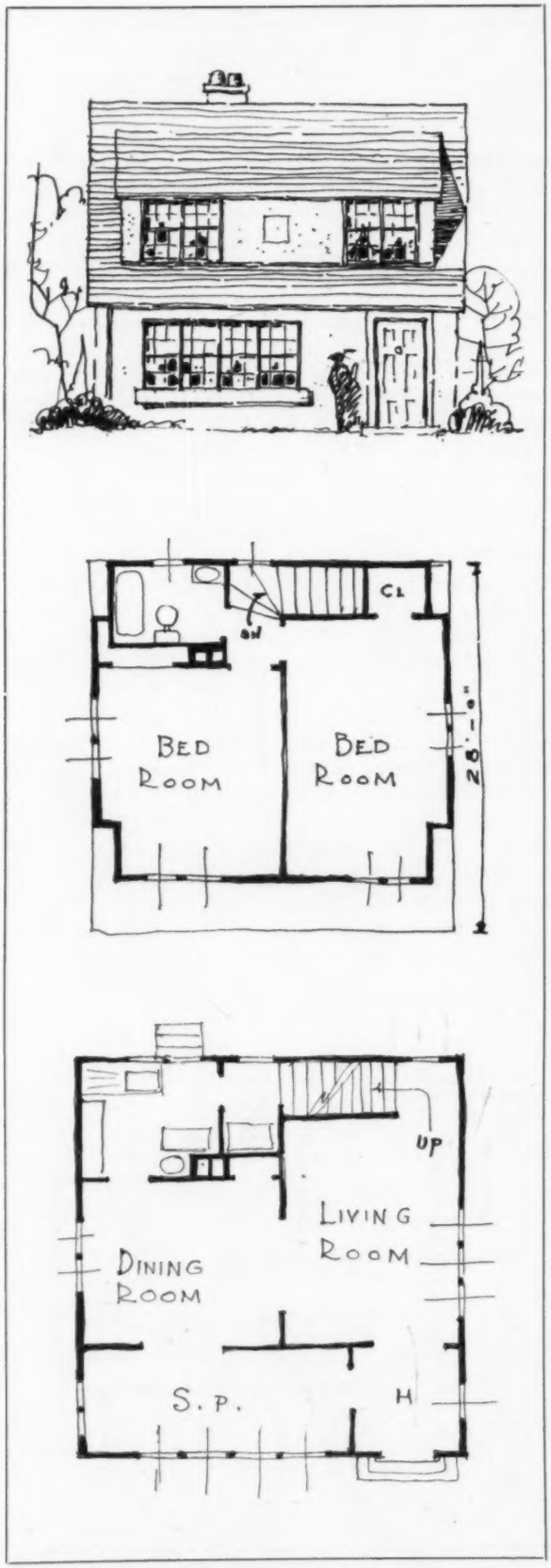


Fig. 3. An Economical Plan for Speculative Houses, Though Monotonous in the Usual Rows

be in even feet. Thus a room with dimensions of 14 feet, 6 inches or 16 feet, 6 inches should be avoided, as 16-foot and 18-foot lumber would have to be cut, and the waste per joist would be 18 inches.

As two-story houses are less expensive to build than those with all of the rooms on one floor, at least part of the dwelling should have a second story. This story need only be large enough to accommodate two bedrooms and a bath, but by having one part of the building taller than the other a more pleasing roof construction is possible. However, there could be no more economical house than that shown in Fig. 3, which is practically square in plan and two stories in height. But the difficulty of giving it a pleasing exterior treatment, and of varying it sufficiently to avoid monotony, when a large number of such houses are to be built along the same street, makes its use inadvisable except for the very cheapest type of developments.

For very small bungalows it is possible to use the four standard units as shown in Fig. 4, with two bedrooms and bath as one unit, the living room another, the kitchen a third, and a garage the final unit. Figs. 4a, 4b and 4c show how these rooms can be grouped so as to vary the exterior appearances and the interior arrangements of the bungalows.

Having considerd the plan and the possibilities of securing variety and interest, even when the room units are standardized, we may turn our attention to the economies possible in the various details of construction.

Foundations. Many houses are now built without basements, but this practice is not to be recommended where houses are to be built as a speculation and for all-year occupancy. Many builders maintain that the basement sells the house and do not dare to invest their funds in houses without this feature. However, it is not necessary to have a basement extending under the entire structure. The cost of excavating the foundation can be cut materially by having a basement just large enough to accommodate the furnace, coal and wood bins, and a vegetable cellar. As a rule, a minimum of 200 square feet will suffice, and the headroom need not be over 7 feet. This, of course, eliminates the possibility of locating the laundry tubs in the basement, but washing facilities can, at a less expense, be obtained by having a combination sink and tub in the kitchen, similar to the usual apartment house practice. All foundations around unexcavated portions need to extend only to the frost limit in the ground, which varies in different localities. Usually from 2 to 2½ feet are enough. Poured concrete basement walls 7 to 8 inches in thickness are always the most economical, providing suitable concrete aggregates are to be found at or near the building site. Concrete blocks 8 x 8 x 16 inches may be used. In soil where good drainage is available, the basement floor need only be 1½ to 2 inches in thickness, made of a good grade of concrete with ¾-inch gravel or stone aggregate. In unexcavated portions care should be

taken to allow 12 to 18 inches of clearance underneath the joists to insure sufficient ventilation. Otherwise the joists and sub-floor will soon be weakened by dry rot, and in specially humid climates they may become covered with fungi.

First Floor System. If poured concrete foundations are used, it is necessary to specify a sill on which to rest the joists, as it is more difficult and expensive to mould the concrete to obtain an absolutely level bed for the joists along the entire foundation. A sill can be laid, leveled up and then grouted at less expense than trying to make the top of the concrete level (Fig. 5). When concrete blocks are used, such a sill is not required, as an experienced mason will have no trouble in laying them level. The joists can be laid directly on the blocks and held in place by an encircling frame as shown in Fig. 6. This frame holds the joists firmly at their ends and results in a saving in the bridging, as one row placed at the joist centers is usually sufficient to obtain a rigid floor system. Over door and window openings this frame is doubled to insure structural safety. A satisfactory seat for the joists can be obtained by nailing a piece of 1 x 2-inch shingle lath to the inside of the frame. It is advisable to carry the sub-floors out over this frame so as to form a complete platform on which to place walls and partitions (Fig. 7). In the first place, this method of support cuts off the basement from the open spaces in the walls, thus forming a fire stop; and secondly, it prevents the builder from nailing his studs to the sides of the joists. The latter practice is objectionable because the joists will shrink and the floor will sink down, leaving open spaces underneath the baseboard, which stays in a fixed position, being nailed to the wall. In regard to the bridging of the joists, it will be found that metal bridging as sold by various manufacturers is much cheaper and more satisfactory than that ordinarily cut from 1x 2-inch shingle lath. No plaster ceiling need be specified for the underside of the joists if it is desired to keep the cost down, although such a ceiling of plaster on metal lath is desirable from a standpoint of fire protection.

Outer Walls. Many different treatments can be given to the outside walls, and such variation will tend to break up the monotony of a row of houses. If stucco treatment is desired, it is most economical to use galvanized wire cloth, usually welded, and manufactured with a waterproof paper backing. This material comes in standard sheets, generally 4 feet wide, which fit the usual stud spacing of 16 inches, making it possible to omit the sheathing. This reduces first cost but increases the fuel costs of the owner. It is poor economy from his point of view to omit any insulation. The scratch coat should be the customary cement mixture, and the finishing coat can be given different textures at low expense. In order to obtain various color effects, nothing is cheaper than cold water paint containing a waterproofing agency. The use of colors already mixed with the cement, which are now obtainable,

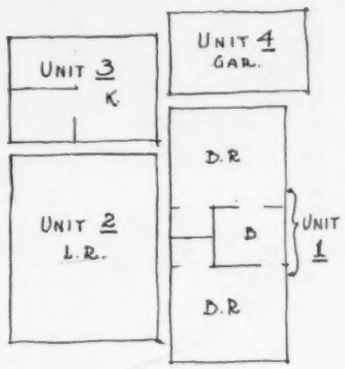


Fig. 4

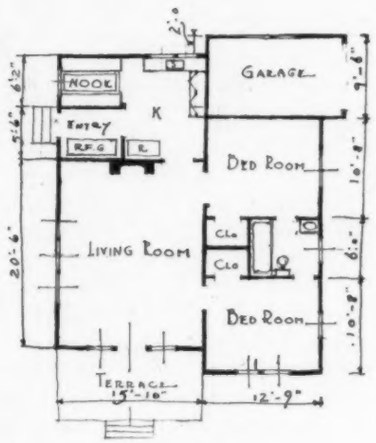


Fig. 4a

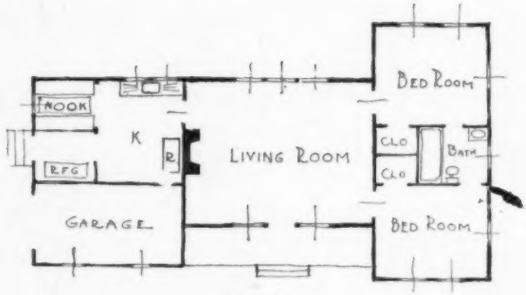


Fig. 4b

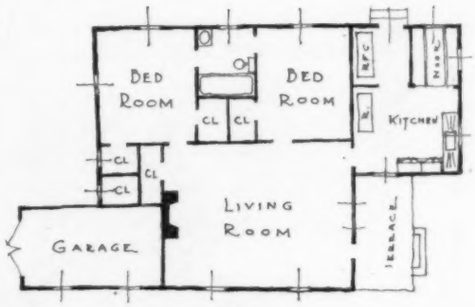


Fig. 4c

The Economical and Standardized Units of Fig. 4 Are Used in Composing the Three Other Plans

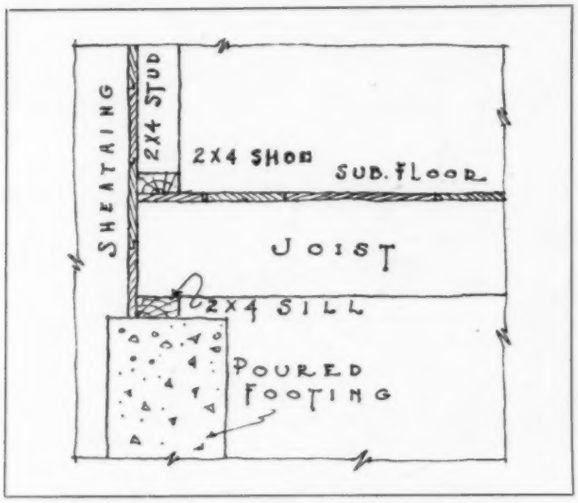


Fig. 5. Section Designed Primarily for Economy, Showing Sill

is much higher in cost, but the quality of the color is far superior to that had by the cheaper painting method. Applying stucco by machinery, that is so-called stucco or cement "guns," has been tried and no doubt can be undertaken economically in certain localities. However, in one instance, in a locality where extremely high winds prevail, this method had to be abandoned because a great amount of material from the gun was blown away before it could reach the wall. Another difficulty is also the tendency of such apparatus to provide a coating of even thickness, which may show the pattern of the wire netting.

Clapboards and shingles are also economical wall coverings, especially when the sheathing is eliminated. When shingle lath is used as a base for the shingles there is a good opportunity for bracing the corners with ⅞-inch boards and butting the shingle lath against the braces. This method is to be preferred to notching and thus weakening the studs to take the diagonal braces. With clapboards or square-edge sheathing, laid so as to overlap, a further economy can be obtained by using uprights at the corners and butting the boards against them, thus avoiding the expense of mitering the boards. Many builders use 2 x 4-inches above the window and door openings, which necessitates use of small pieces forming a truss between the top of the opening and the plate. A less expensive, more efficient and structurally stronger framing can be obtained by specifying the distance from the underside of the plate to the top of the window frame as 6, 8, 10, or 14 inches, permitting the use of 2-inch planks of the given dimensions, doubled as shown in Fig. 8. An economical way of framing the corners so as to provide nailing for both the outer and inner wall coverings is to be found in the so-called "Dutch post," which is built up of three 2 x 4-inch studs.

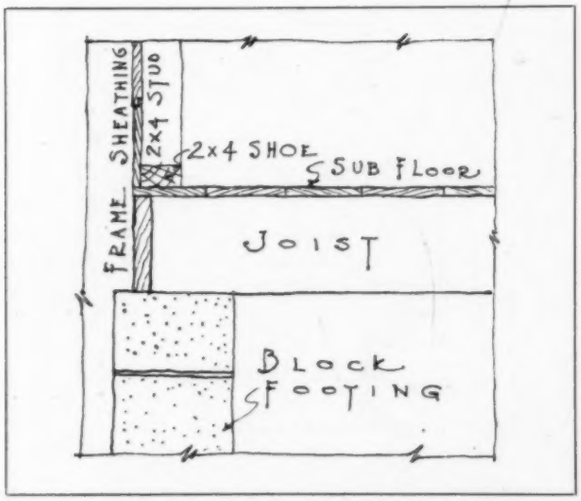


Fig. 6. Section Showing Use of Encircling Frame with Joists Resting Directly on Blocks

Interior Wall Treatment. As the interior treatment of a house is much more expensive than the exterior, great care should be exercised in choosing the various materials and the methods of application. The use of wall board is generally costly unless the walls are to be papered, as wall paper can be directly applied on wall board. It is rather expensive to use wall boards with the necessary "cats," pointing up of the joints and taping them in order to obtain a sufficiently smooth surface to take an architectural finish. In the writer's experience it has been found cheaper to use plaster board and to apply a white coat to it, treating its surface with trowels, sponges, brushes, etc., in order to obtain the desired finish. A very satisfactory interior wall can be obtained at a minimum cost by using some kind of plaster-saver lath covered with a scratch coat and a sand-finished brown coat, thus omitting entirely the white coat. To such a wall it is necessary to apply a coat of sizing or the cost of subsequent painting will be rather high. What has been said about interior wall treatment is equally applicable to ceiling finishes. The cost of woodwork can be kept down to a minimum by using a single-member base in conjunction with the usual trim around doors and windows.

Roof Construction. A certain amount of the charm and effect of a house is dependent upon the shape of the roof and the materials used thereon. One of the most effective and inexpensive roof constructions consists of wood shingles laid 5½ inches to the weather, nailed to 1 x 2-inch shingle lath. Lately No. 1 ribbon slate has been quoted at such a low figure that if laid on shingle lath, the cost may only be $2 or $3 more per square. Asphalt strip shingles laid on continuous sheathing are also a very economical form of roofing, and contrasting color effects may be obtained easily. However, such shingles have a tendency to curl eventually, and a double-dipped asphalt shingle will be found to be more economical, although it may increase the cost about $4 a square. In designing a roof it should be

borne in mind that dormers, hips, valleys, etc., are expensive and should be avoided as far as possible. The cost of adding a small dormer containing a window may vary from $20 to $30. Great care should be exercised in detailing the roof overhang both on the rakes and eaves, and much trouble can be avoided if the shingles or roof sheathing is carried out over a moulding and bedded over it in mastic cement or other plastic, non-drying compound.

Fireplaces and Chimneys. Although open fireplaces are much to be desired in all houses, they should be avoided in speculative work if the expense is around $300, unless it is felt that a fireplace will have great weight as a selling point and will thus pay its way. If a fireplace is desired, it should be so located as to contain all of the required flues in its surrounding brick masonry. Every house designed for winter occupancy in a northern climate must have a furnace, and if the building site is located where gas cannot be obtained, there should be an additional flue for the kitchen range. Fireplaces projecting through outer walls should be avoided, as the outer and visible part of the masonry must be given architectural treatment and this, as a rule, involves use of a greater quantity of brick. The beauty of such an outer chimney is not disputed, but it represents considerable expense. Furthermore, the type of house we are considering is usually occupied by families of small means, and it is a well known fact that an outside chimney is not as economical as one located entirely inside of the house, where the radiation of heat through the masonry helps to keep the house warm. An ideal location for a fireplace is shown in Fig. 1, where the masonry containing the flues need be of minimum dimensions, as only the chimney top is visible above the roof line.

Millwork. Another item that involves a great deal of expense is special millwork. In order to keep the cost down it is advisable to select standard millwork from the catalogs of reputable millwork concerns, and it is usually found that there is a sufficiently great variety of sizes and shapes offered to satisfy all reasonable requirements. In selecting the sizes of the windows, it should be borne in mind that the use of several different odd shapes or sizes on the same house involves unnecessary expense, because the carpenters must hunt among the frames to find the particular one wanted. It is, therefore, well to limit oneself to two or possibly three different sizes of windows and two sizes of interior doors. The most convenient sizes for interior doors are the stock 2 feet, 6 inches x 6 feet, 8 inches or 2 feet, 6 inches x 7 feet for room doors, 2 feet x 6 feet, 8 inches or 2 x 7 feet for closet doors. It will facilitate the construction if the "heads" of all door and window openings are at the same height above the floor.

Bathrooms. Nothing is more pleasing to the eye than a well proportioned bathroom with tile floor and walls, but unfortunately this involves use of

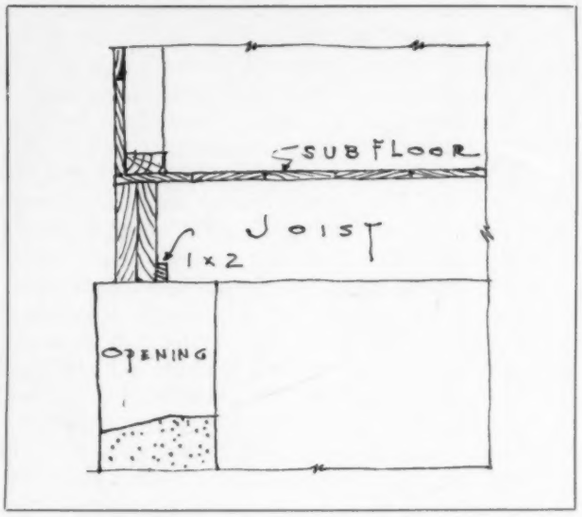


Fig. 7. Section Showing Sub-floor Running Through and Joists Resting on Minimum Nailing Strip

expensive materials and workmanship. Where strict economy is desired, the floors may be covered with linoleum. The walls, up to a height of 4 feet, can be provided with a wood sheathing to which may be secured one of several different types of wall board that have a pressed tile pattern. The upper edges of the boards may be covered by a ⅞ x 2-inch or a ⅞ x 2½-inch dado cap and the rest of the walls

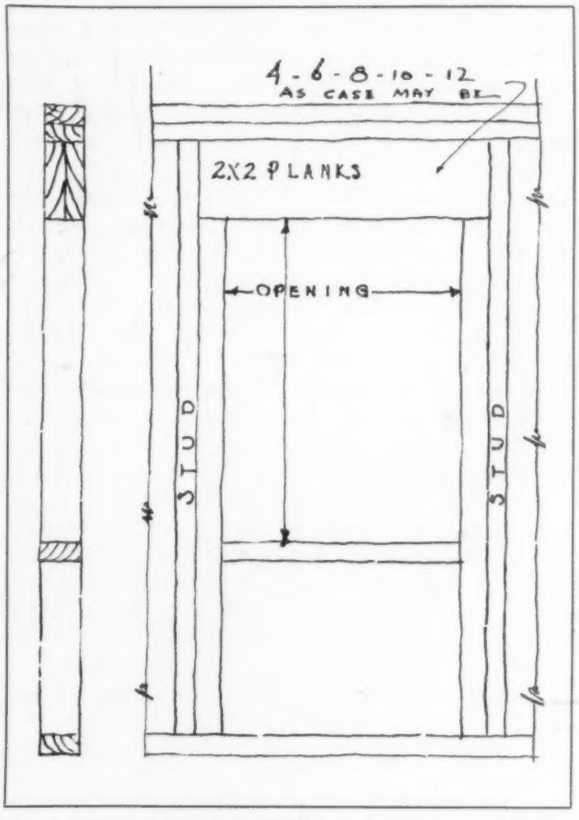


Fig. 8. Economical and Efficient Framing of Window and Door Openings

given two coats of sand-finished plaster. Another type of economical finish can be obtained by plastering the lower portion of the walls, but if such walls are not given an extra good coat of paint, they will soon disintegrate, especially around the bathtub and the lavatory. The fixtures can be selected from manufacturers' catalogs, and a local plumber consulted as to which fixtures he can obtain at reasonable prices. Often such plumbers are able to obtain a good grade of second-class fixtures that are unimpaired from a sanitary and mechanical standpoint, and there is no reason why such fixtures should not be acceptable. The use of brass pipe may be desirable in certain localities, and it behooves the architect to familiarize himself with the quality of the water in the particular locality. In many places, especially where good artesian water is available, wrought iron pipe will be found to give good and lasting service at low cost.

Heating. Many different opinions are put forward as to the most efficient and economical system of heating for a small house, but the writer has found none to compare with warm air systems in economy and efficiency. If a house is small, compact, and contains only one or two small rooms on the second floor, a pipeless furnace should be given serious consideration. If a house is beyond the capacity of a pipeless furnace, warm air systems should be looked into, especially those now used in many localities of this country. Many such have "cold air" registers inside of the house, and the furnace, therefore, is only called upon to add a few degrees of heat to this already heated air in order to keep the rooms at the desired temperature. There is a type in which an adequate amount of humidity is supplied to the air by the furnace. In this a surplus of water escapes from a humidifier into the ash pit, where it is evaporated and mixed with the air passing through the live coals, thus making the furnace act more or less as a gas producer, increasing the combustible value of the coal. For a small house a pipeless furnace could be installed for about $150, and the warm air furnace would cost from $300 to $350, at the present writing. Should the house be of bungalow type and rather elongated, neither of the heating systems mentioned can be used, and it is necessary to resort to other types, using hot water, or high- or low-pressure steam or vapor. For the small house it is believed that the hot water system is the best, but due to the slowness of operation it can hardly be used satisfactorily in localities subject to sudden temperature changes. Steam will be more satisfactory in such places, as it is possible to drive such a heating plant and obtain quicker results.

Painting. Much money may be spent on the exterior and interior painting of a house, and much of this can be eliminated where economy is the prime consideration. All outer trim and woodwork, including clapboards, must be painted with three coats of good lead and oil in order to prevent checking, but shingle and stucco walls may be left *au naturel.* The painting of the interior woodwork depends largely upon the class of material used. For instance, yellow pine trim may require a coat of shellac before applying the paint. For cypress or white pine, two coats of a good grade of paint are usually sufficient. A very satisfactory and inexpensive effect can be obtained by using yellow pine trim and simply staining it. For pine or fir doors it will be found economical to mix varnish with the first coat, using a flat white paint. A second coat of paint in the desired color will then suffice in order to obtain a satisfactory and economical finish. Sand-finished interior walls can be left without further treatment, but if they are to be painted they should be sized for oil paint, or a good grade of cold water paint applied.

Flooring. Sub-floors are absolutely necessary only in the first floor system, and then really only over unexcavated portions. Floors over basements and all second floors need not have sub-floors. It is advisable to have at least the living room provided with hardwood flooring, but in all other rooms to have a cheaper grade of fir or N. C. pine flooring. In kitchens and bathrooms, which are to be covered with linoleum, economy can be obtained by using flooring 6 inches wide of fir or spruce, but such flooring must be "face nailed" in order to prevent curling.

In Conclusion. The aim of this article is to emphasize the methods that can be used successfully in obtaining economical small houses without sacrificing their architectural beauty. Some months ago an architect said that in his opinion the days of the $5,000 house had passed, and he was rather surprised when shown a house of sizable proportions which had just been completed within that amount, and that there were no secrets as to how this had been accomplished. The entire undertaking had been standardized to such an extent that several days before the building operation was begun, carpenters had been busy cutting studs, framing for window openings, joists, and roof rafters, and stacking them on the ground ready for use. The millwork was all selected from a manufacturer's catalog and was on the ground before the building was started, so that it was possible to place all exterior frames of the house before sheathing. Several changes had also been made in the plans in order to have as little waste as possible in the lumber, and the labor was so supervised and organized that every man knew exactly what to do next.

HEATING AND VENTILATING SYSTEMS IN PRELIMINARY DESIGN

BY

HAROLD L. ALT and PRICE L. ROGERS

HEATING AND VENTILATING ENGINEERS

THE procedure most frequently followed in the designing of the modern building would be humorous if it were not so expensive. As engineers of considerable experience in this class of work, the writers feel that the system they have encountered must be universal. The usual procedure is to have the architect make preliminary studies and to give these to the engineer, who approximates the amount of heating and ventilating necessary, making certain recommendations to the architect. The architect then begins to make a further serious study of the matter in an endeavor to incorporate the engineering requirements in the preliminary designs without destroying the general scheme. In making various alterations to do this, certain improvements suggest themselves and are also incorporated. Other suggestions of the engineer it may be impossible to accommodate in the preliminary design as contemplated, and the architect then makes some really radical departures from the original scheme in order to give the engineer what he wants. One good turn deserves another, and one little change often results in several more, so that by the time the plans go to the engineer a second time they are often,—as far as heating and ventilating are concerned,—unrecognizable to the engineer. As a result of this the engineer starts all over again and has to develop an entirely new set of requirements to suit the revised layout. Then the architect takes another try at it and again revises; this game of battledore and shuttlecock goes on until the alterations and their effect on the heating and ventilating system become small enough to be practically negligible. At this point the plans may be said really to be ready for the engineer to begin his work of the incorporating of the equipment.

There are so many ways and means of heating and ventilating that to lay down hard and fast rules for the architect's information is exceedingly difficult; one engineer will ventilate in a manner that another engineer wouldn't use under any circumstances, and another engineer will design a heating system entirely different from that employed by some of his engineering brothers. Yet each one is going by what his experience has taught him and is using, to the best of his ability, his brains and his craft to produce the most for the owner's investment. And neither can be condemned any more than one of two architectural designs can be condemned when they are of equal beauty and practical utility.

Inadequate Preliminary Drawings. Preliminary plans are often inadequate,—as far as heating and ventilating are concerned,—especially in the matters of,

(a) Boiler Room Space,
(b) Chimney Sizes,
(c) Flue and Duct Spaces,
(d) Pent Houses for Fans,
(e) Connecting Openings between Boiler Room and Building.

Of all the items listed, the first seems to be that which gives the most trouble. Even in finished designs, boiler rooms are often too small, incorrectly located, and put in places to which access is difficult. In preliminary drawings the boiler room area is not only insufficient as a rule, but the height is almost as often entirely inadequate, necessitating the raising of ceilings or the dropping of floors, to allow boilers and steam piping to be installed. When considering the location of the boiler room it is most important to select a location where the handling of coal, ashes or oil will be convenient, and where the steam may be distributed to the building in an economical manner from the standpoint of the pipe layout. Since the greatest heating load usually occurs on the north and west sides of a building, it is often desirable to locate the center of steam distribution somewhere near the northwest corner. In H-shaped buildings the best position is generally in the cross-bar of the H. It is evident that this placing of the boiler room will result in shorter average runs and in reducing the amount of large-size pipe required.

Next to the boiler room difficulty, and it is a close second, is the matter of size and height of the chimney. Often a high chimney might seriously affect the architectural beauty of the building; yet the architectural beauty will not keep the tenants of the building warm, and that is what the high chimney might aid in doing. In recent years this question of chimney height has in many cases provided its own answer because of the increasing heights of new buildings; yet, even today, the average building seldom has the height necessary to give adequate draft without extending the chimney a considerable distance above the roof.

Hardly less important is the matter of duct and flue space; here the difficulty is not so hard to understand, because the amount of duct and flue space is not fully determined until the ventilation requirements of the building have been decided upon, and the exact locations of these ducts and flues are often unknown even to the engineer until he begins trying to install the ventilating system. Ventilation differs so profoundly in various types of buildings that the space entirely suitable for one type of structure is absolutely unsuited for another type of equal cubage. There are *upward* ventilation and

downward ventilation, ventilation *without* cooling and ventilation *with* cooling, and sometimes no ventilation at all. Consequently, in talking about duct and flue spaces, the type and size of the building itself will control the amount of space needed for ducts and flues, and the method of ventilating will have large influence in determining where these spaces should come. Pent houses on the roof are normally the least difficult of all details to take care of, but their general locations should be selected and sufficiently strong construction provided that these structures may be added when required without affecting the framing way down to the basement.

Approximating the Heating Requirements. Assuming that the approximate cubage of a building is known, it is possible to approximate the heating requirements where the outside temperature goes to zero by dividing the total cubage by the factors shown in Table I. This gives the total radiation which would be necessary if ordinary standard cast iron radiation were used. Of course it is only approximate. This amount of radiation will be called the equivalent amount of direct radiation required and, hereafter, will be abbreviated to E.D.R. (Equivalent Direct Radiation). From this E.D.R. the boiler size can be determined, as far as the heating is concerned, by choosing a boiler that will give this amount of radiation. In other climates this E.D.R. will vary as the temperature outside rises, and in this manner, with zero outside and 70° Fahr. inside, the difference between the room temperature and the outside temperature is 70° Fahr. With any other difference, the E.D.R. will be found by using the equation,—Actual Temperature Difference÷70×E.D.R. equals Actual E.D.R. Thus if the building were situated in a climate where the minimum outside temperature only fell to 35° Fahr., the E.D.R. as calculated using the factors in Table 1 would have to be modified to

35/70×E.D.R. which equals ½ E.D.R.

which is only another way of saying that, with half of the temperature difference, the equivalent direct radiation would also be only half, and, with three-quarters of the temperature difference, the E.D.R. would be only three-quarters as much.

TABLE I

Divisors to be Used to Determine the Approximate Direct Radiation Load in Various Types of Buildings

Class of Buildings	*No. of Buildings Averaged*	*Ratio of E. D. R. to Cubage*
Residences,	16	1 to 46
Churches,	4	1 to 86
Schools (private—no ventilation),	2	1 to 72
Schools (public—ventilated),	4	1 to 72
Factories (60° rise only),	10	1 to 72
Office Buildings,	9	1 to 76
Apartment Houses,	11	1 to 76
Hotels,	15	1 to 74
Hospitals.	3	1 to 66

Note—By "cubage" of a building as used in the above table is meant the *total* cubage which has been computed, exclusive of attics and unheated spaces.

Approximating the Ventilation Requirements. With ventilation the figures will be less accurate because the quantity of ventilation is not fixed by such a positive factor as the outside temperature. In calculating probable ventilation requirements. only average conditions can be assumed, and they will not fit any special case exactly, although they should fit approximately.

It has been found in various buildings that, with reasonably good ventilation throughout,—say, three to six air changes per hour,—the ventilation load will run about 100 per cent of the radiation load. Where excellent ventilation is expected, this figure may be increased to 150 per cent, while in buildings where the air changes are to be cut down to the minimum the additional load may be only in the neighborhood of 50 per cent of the E.D.R. for the same building. Such figures will apply to office buildings, institutions, hospitals and other buildings where the occupants are not crowded together in confined spaces, such as occur in auditoriums and school buildings.

Developing the Boiler Capacity Required. To obtain the approximate boiler horse power necessary for the building, it is only necessary to divide the sum of the E.D.R. for heating plus the E.D.R. for ventilating, plus about 25 per cent for hot water and incidentals, by 100. For example, suppose a hospital of 1,000,000 cubic feet with fairly good ventilation expected and a minimum outside temperature of 10° Fahr. above zero. The E.D.R. for heating would be for zero outside. . . .

1,000,000/66 or 15,151 sq. ft. for heating

but as the outside only goes to 10° Fahr. above zero the E. D. R. is revised to

60/70 of 15,151 or 12,986 sq. ft., say 13,000 sq. ft., and with fair ventilation throughout, the ventilation load would add about 100 per cent, or 13,000 square feet more, making a combined load of

13,000 sq. ft. E. D. R. for heating,
13,000 sq. ft. E.D.R. for ventilating,

26,000 sq. ft. E.D.R. combined load,
6,500 sq. ft. for incidentals,

32,500 sq. ft. E.D.R. total which, divided by 100, equals 325 boiler horse power. In order to have one spare boiler, it is logical to assume that three boilers would be used, each of 160 b.h.p.

There are boilers of all shapes, makes, and sizes; long and short, high and low, water-tube, fire-tube, etc.; no boiler room could accommodate *efficiently* all types of boilers; yet it is wise to try to make the boiler room large enough to accommodate any one of several types of boilers large enough for the building. The three most general classifications of boilers are, cast-iron sectional for low-pressure use;

Boiler Horse-power	Steel Boilers						Cast Iron		
	High Pressure Water Tube			Low Pressure Fire Tube			Low Pressure Horizontal		
	Wdth.	Lgth.	Hgth.	Wdth.	Lgth.	Hgth.	Wdth.	Lgth.	Hgth.
50	–	–	–	(2) 23′	20′	14	(2) 21′	20′	13′
100	(2) 42′	19′	19′	(2) 23′	25′	16′	(2) 21′	22′	13′
150	(2) 42′	21′	19′	(2) 25′	27′	20′	(3) 31′	21′	13′
200	(2) 42′	22′	19′	(3) 33′	26′	16′	(3) 31′	23′	13′
250	(2) 42′	27′	19′	(3) 33′	28′	18′	(4) 39′	21′	13′
300	(2) 42′	33′	19′	(3) 36′	29′	20′	(4) 39′	23′	13′
350	(3) 42′	48′	19′	(3) 36′	32′	20′	(5) 48′	22′	13′
400	(3) 42′	37′	19′	(3) 36′	34′	20′	(5) 48′	21′	13′
450	(3) 42′	39′	19′	(3) 36′	35′	20′	(5) 48′	24′	13′
500	(3) 42′	39′	19′	(4) 47′	31′	20′	(6) 57′	23′	13′
550	(3) 42′	43′	19′	(4) 47′	33′	20′	(6) 57′	24′	13′
600	(3) 42′	43′	19′	(4) 47′	35′	20′	(7) 66′	23′	13′
650	(4) 42′	45′	19′	(4) 47′	35′	20′	(7) 66′	24′	13′
700	(4) 42′	45′	19′	(4) 47′	37′	20′	(8) 75′	23′	13′
750	(4) 42′	48′	19′	(5) 58′	31′	20′	(8) 75′	24′	13′
800	(4) 42′	48′	19′	(5) 58′	33′	20′	–	–	–
850	(4) 42′	48′	19′	(5) 58′	35′	20′	–	–	–
900	(4) 42′	48′	19′	(5) 58′	38′	20′	–	–	–
950	(5) 42′	60′	19′	(6) 69′	33′	20′	–	–	–
1000	(5) 42′	60′	19′	(6) 69′	37′	20′	–	–	–
1100	(6) 42′	66′	19′	(6) 69′	37′	20′	–	–	–
1200	(6) 42′	66′	19′	(8) 91′	31′	20′	–	–	–

TABLE II

TABLE SHOWING APPROXIMATE DIMENSIONS FOR BOILER ROOMS BASED ON THE USE OF HIGH-PRESSURE CROSS-DRUM STEEL BOILERS, LOW-PRESSURE FIRE-TUBE STEEL FIREBOX BOILERS, AND CAST-IRON LOW-PRESSURE HORIZONTAL SECTIONAL BOILERS

Note. Figures in parentheses as (1), (2), (3), etc., indicate the number of boilers contemplated, of which one will be a spare. If mechanical stokers are to be used on water-tube boilers, reduce the length about 40 per cent and add 5 feet to the height.

steel fire-tube for low-pressure; and steel water-tube for high-pressure. For this reason the architect should decide as soon as possible if high-pressure steam will be needed for any purpose and, if not, whether he wants to use low-pressure steel boilers, or the cast iron sectional type. It will make a great difference with the boiler room in many ways, and competent advice should be sought if it is not available in the architect's own office.

Dimensions of Boiler Rooms. Table II shows the approximate dimensions of boiler rooms required for plants of different types, including the minimum height necessary to accommodate such boilers. It should be noted that where mechanical stokers are to be placed under water-tube boilers, the height must be increased about 5 feet, as boilers are usually set higher for stokers than for hand firing. Oil fuel often makes it necessary to raise fire-tube boilers to get sufficient combustion space, but this amount of rise is not generally enough to affect the height of the boiler room materially. It is important to remember that with steel boilers space must be provided either at the front or at the rear sufficient to draw the tubes for cleaning or repair; this, in most cases, nearly equals the length of the boiler. If a boiler room is sized according to the information given in Table II, it may not be possible to get every manufacturer's boiler into this space, but *most* boilers will go in, and it is assured that, at least, *some* boiler will fit.

It must be understood that the dimensions given in Table II include space for boilers only; usually there are certain other pieces of apparatus, such as boiler-feed pumps, automatic-return pumps, vacuum pumps, feed-water heaters, house pumps, water filters, air compressors, hot-water heaters and storage tanks, which will have to be accommodated in space outside of that quoted. It might be said that a floor area of about 50 per cent of the boiler room is generally sufficient to receive all such equipment.

Chimneys for Boiler Plants. Consideration should be given to the fact that a certain height must be provided to produce the *intensity* of draft, and a certain area is required to carry off the *volume* of gas. The exact minimum height cannot be determined until the full details of the steam plant are decided upon and the overload—if any—on the boilers determined. Approximations covering average conditions are quoted in Table III, which may serve to give some idea of the height and size necessary as soon as the boiler load has been calculated as previously explained. For oil-burning plants the height of chimney uusally need not exceed 80 feet, and the area—*not the diameter*—need be only about two-thirds of the area which would be required for a coal installation. Care should be taken of course to be sure that the use of coal in the future is such a remote possibility that it may be neglected before the area of the chimney is reduced, as height can be added, but to increase diameter is usually impossible after the chimney is once built.

Boiler Horse-power	Coal		Oil	
	Dia. In.	Hgth. Ft.	Dia. In.	Hgth. Ft.
50	21	50	18	80
100	27	60	22	80
150	30	70	24	80
200	36	80	30	80
250	40	90	34	80
300	42	100	36	80
350	42	110	36	80
400	48	110	40	80
450	48	125	40	80
500	54	100	45	80
550	54	110	45	80
600	60	100	50	80
650	60	110	50	80
700	60	125	50	80
750	66	100	54	80
800	66	110	54	90
850	66	125	54	90
900	72	110	60	90
950	72	110	60	90
1000	72	125	60	90
1100	72	150	60	100
1200	78	125	66	100

TABLE III

Showing Approximate Diameters and Heights of Chimneys for Various Sizes of Plants, Using Coal or Oil Fuel

Mechanical Draft Objectionable. Low chimneys are sometimes necessary and can be used only in combination with some form of mechanical draft. Any artificial means of draft production is expensive, as it entails greater internal losses in the boiler plant and introduces additional expense in the first cost, which in turn raises the interest charge and depreciation. Mechanical draft should be avoided wherever possible. The little undergrate electric-driven blower for intermittent use is a cheap and useful adjunct to a building's heating plant, but installations carrying mechanical draft beyond this point are of questionable desirability.

Areas for Toilet Exhausts. In regard to duct and flue spaces necessary to ventilate, the toilets will have a larger air change than the ordinary rooms, so that this must be allowed for in settling the duct area required. If it is assumed that the toilet, locker and similar rooms are exhausted to the extent of ten air changes per hour, the duct area in square feet near the toilet will be $\frac{1}{2400}$ of the cubage ventilated, this gradually decreasing as the fan is approached to a point close to the fan, where the area will be about $\frac{1}{6000}$ of the cubage handled.

For example, assume a toilet and locker room of a total cubic contents of 5,000 feet, and about half-way from this toilet room to the fan is located a second room of 3,000 cubic feet. Then the duct area for the first room will be

$$5{,}000 \times \frac{1}{2400} \text{ or } 2\tfrac{1}{4} \text{ sq. ft.}$$

and where the second room comes in the duct for the second room will be

$$3{,}000 \times \frac{1}{2400} \text{ or } 1\tfrac{1}{4} \text{ sq. ft.}$$

As the two ducts unite at a point about half-way to the fan, the combined duct will have an area about half-way between $\frac{1}{2400}$ and $\frac{1}{6000}$ or, say, $\frac{1}{4200}$ of the total cubage handled. Then

$$(5{,}000 + 3{,}000) \times \frac{1}{4200} = 2 \text{ sq. ft. area}$$

and if no more connections come in, the area at the fan would reduce to

$$(5{,}000 + 3{,}000) \times \frac{1}{6000} \text{ or } 1\tfrac{1}{2} \text{ sq. ft. approx.}$$

Areas for Ordinary Ventilation. In other rooms, involving normal ventilation of say six air changes per hour, the factors would change from $\frac{1}{4000}$ at the room, down to $\frac{1}{10000}$ at the fan; and rooms with ducts connecting into the main line at intermediate points would have the main line duct carrying the total of all rooms supplied beyond any given point, and the factor would be approximately proportional to the distance of the point from the fan. That is, at a point one-quarter of the way from the fan to the end of the system the factor would be about $\frac{1}{8500}$, a point half-way between the fan and the end of the system would use about $\frac{1}{7000}$, and one three-quarters of the way would use $\frac{1}{5500}$.

To illustrate, assume two rooms with a cubage of 2500 each at the point farthest from the fan, another room with a cubic of 7000 cubic feet about one-third the distance nearer the fan, and a fourth room of 5500 cubic feet very close to the fan. The areas which will have to be provided to accommodate ducts and flues for these rooms will be:

First two rooms, $2500 \times 2 \times \frac{1}{4000}$ or $1\frac{1}{4}$ sq. ft.

After taking on the next room the area will increase to

$$[(2500 \times 2) + 7000] \times \tfrac{1}{6000} \text{ or } 2 \text{ sq. ft.}$$

When the fourth room is added the duct area becomes $(2500 \times 2 + 7000 + 5500) \times \frac{1}{10000}$ or $1\frac{3}{4}$ sq. ft. Supply ducts can be approximately determined by the same method.

Theaters and Schools Require Special Consideration. In theater work the cubic contents need not be considered, as the ventilation is based entirely on the number of occupants, and running from 20 to 25 cubic feet per minute per occupant. Schools follow the same rule except that they use 30 cubic feet per pupil. In these cases it is only necessary to multiply the number of occupants by the cubic feet supplied per hour and use one-sixth of this figure in place of the cubic contents to determine the duct sizes. When cooling is to be installed, the air quantity for theaters must be materially increased, reaching nearly double, and, sometimes full double that required for plain ventilation. It is essential that the sizes of ducts and flues running to the roof space over the auditorium must be sufficient to supply all occupants in the gallery and on the ground floor except the seats under the balcony; these should be supplied from the ceiling under the balcony and not from the main ceiling.

Theater Duct and Flue Areas. For every occupant supplied from the main ceiling, about 0.025 square feet of flue or duct area must be allowed, and for every occupant seated under the balcony about 0.033 square feet. The exhaust leaving at the floor either through the usual mushroom, or by other means, may be sized in the same manner, except that it must be remembered that the mushrooms in the balcony should care for all balcony seats and the mushrooms in the main floor for all the main floor seats.

As an example of the application of this, assume a theater of 3000 capacity with 1000 in the balcony and 800 under the balcony. With plain ventilation the duct going to the roof space above the main ceiling would have to carry air for all seats except the 800 under the balcony, so that the size of this duct would be

$$(3000 - 800) \times 0.025 \text{ or } 55 \text{ sq. ft.}$$

and the size of the duct going to the registers in the ceiling under the balcony would be

$$800 \times 0.033 \text{ or } 26 \text{ sq. ft.}$$

while the duct coming from the balcony mushrooms would be

1000×0.033 or 33 sq. ft.

and the duct from the ground floor mushrooms would be

2000×0.025 or 50 sq. ft.

When cooling is to be carried on, these areas should be increased by at least 90 per cent.

School Flues and Ducts. In schools the air quantity often required by law is 30 cubic feet per minute per pupil, and the average schoolroom works out with a supply flue and an exhaust flue each of 3¾ to 4 square feet area, assuming 50 pupils. Where trunk lines are used, such as in the attic exhaust lines, the area of the trunk line will run from 0.075 square feet per pupil served at the far end down to 0.03 square feet per pupil served near the fan. Intermediate points will range between these two figures, as has already been explained. In the basement the total duct area will keep within the same limits, although if single ducts are used for each room the basement duct area will be not less than 0.04 square foot per pupil. Where unit heaters are used, exhaust flues only will be required, flues generally terminating in a plenum space in the attic.

Apparatus Rooms. The sizing of apparatus rooms, i. e., the rooms for receiving ventilating equipment, will vary considerably in different apparatus arrangements; where pre-heaters, air washers, re-heaters, and fan are used, the length of the apparatus room, in order to set these in proper order and continuously in line, may be between 27 feet and 35 feet, the longer dimension being required for larger sets of apparatus. The width of the room will vary with the quantity of air being handled, and the width of the air washer should first be developed. This can be determined by calculating the air washer area, which is obtained by dividing the cubage ventilated by 5000. Then, if the height of the air washer is approximately equal to the width, the width will be the square root of the area, and the height will be the square root of the area plus about 2 feet for the pan under the washer. In cases where it is desired to keep within a limited headroom, the area of the washer may be divided by the headroom minus 2 feet, in order to determine the width. The width of the room must be sufficient to accommodate not only the washer but the circulating pump and the connections to the heaters, and to leave a working space around the apparatus. Therefore the width of the room should be approximately the width of air washer plus 8 feet.

As an example, assume that ventilation is being supplied to a cubage of 1,000,000 feet and the size of apparatus room is desired where headroom of 13 feet is obtainable. Then the area of the air washer will be $\frac{1{,}000{,}000}{5000}$ or 200 square feet, and as the headroom is 13 feet, the width of the washer will be $\frac{200}{13\text{-}2}$ because the pan under the washer and a little clearance over the top will equal a reduction of 2 feet in the effective washer height.

200/11 is 18 feet, the width of washer.

18 feet plus 8 feet equals 26 feet, the width of room. The length of room (as this is a large capacity equipment) will be about 30 feet. The height of room has already been given as 13 feet.

Pent Houses on Roofs. Some idea of the probable size of the pent house for exhaust fans on the roof may be gained by assuming it to be a cube, the cubage of which equals the cubage ventilated divided by 250. This assumption will do down to pent houses of about 200 cubic feet capacity for direct-connected exhaust fans, and down to about 500 cubic feet in the pent houses for belted fan installations. No pent house should be made for less than these minimum amounts, and for belted fans the dimension of the pent house parallel to the belt should not be less than 12 to 13 feet on small units, up to 17 feet or so on large units serving a million cubic feet in the ventilated portion of the building.

Fuel Storage. It is generally conceded that the absolute minimum fuel storage allowable is a three-day supply to take care of a holiday falling on Monday, etc. In Table IV is given a schedule covering the number of cubic feet of storage space necessary for one day's supply of coal and the number of gallons necessary for one day's oil consumption. These amounts can be multiplied by the number of days desired, and the total will be the space required. It should not be forgotten that the amounts quoted in Table IV are the amounts based on a heating plant operating at 100 per cent of its capacity; in other words, they are based on extreme weather conditions, and in ordinary winter weather, with the temperature around 30° to 35° Fahr., the fuel consumption will only run about half as much as indicated.

TABLE IV

Approximate Fuel Consumption for One Day of Extreme Weather

Horsepower	Soft Coal	Weight	Hard Coal	Oil
Required	Cu. Ft.	Tons	Cu. Ft.	Gals.
50	94	2	90	340
100	188	4	180	680
150	282	6	270	1020
200	376	8	360	1360
250	470	10	450	1700
300	564	12	540	2040
350	658	14	630	2380
400	752	16	720	2720
500	940	20	900	3440
600	1128	24	1080	4080
800	1504	32	1440	5440
1000	1880	40	1800	6800
1200	2256	48	2160	8160

Note. This is figured on running 24 hours per day; for 18-hour periods of operation use ¾ of these quantities, and for 12-hour operation use ½. If a cheap, heavy oil is to be used, the number of gallons given may be increased by about 40 per cent.

ARCHITECTURAL LAW

ZONING, TRAFFIC, AND BUILDING TYPES

BY

ARTHUR C. HOLDEN, ARCHITECT

Editor's Note.—Leonard Cox, of the office of Arthur C. Holden & Associates, Architects, is serving as Architectural Consultant to the Temporary Commission to Examine and Revise the Tenement House Law. In the standards recommended herein, Mr. Holden has closely followed the standards proposed in the report of the Commission to the state legislature. The text itself is a part of recommendations made for the amendment of the Building Zone Resolution of the City of New York.

IN the discussion of congestion today we hear much concerning the high building and of overtaxed streets. Many generalizations are made as to whether or not our skyscrapers are a blessing or a menace; whether they should be permitted or legislated out of existence; and whether or not it is possible to do something to the streets that will make it possible for them to function a little better. There is some show of debate, too, as to whether traffic is as bad or worse in a city of low buildings like London than in our own skyscraper town of New York. In all this welter of discussion there has so far been little attempt to analyze the situation and separate individual facts from generalizations of opinion.

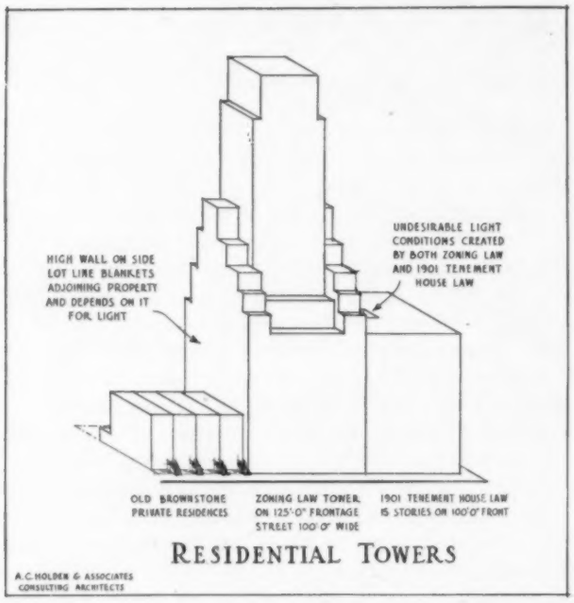
Divergence of Skyscraper Types. It may be just possible that high buildings need not be condemned *en masse*. Perhaps all skyscrapers are not alike; some may be good and desirable, while others may be harmful and therefore not so desirable. Some may cause congestion, and others may reduce congestion. Perhaps the deplorable congestion of street traffic may in some cases actually be due to high buildings, and in others to the increasing use of the automobile, and in still other cases the cause may be a bad street plan. The attempt to differentiate should at least be made. There have been developed in the last dozen years three main types of the very tall building,—the office type, the residential type, and the loft type. Of these only one,—the office building,—had begun to approach its present stage of development in New York when the zoning law regulating height and bulk of buildings was passed in 1926.

The zoning law established limitations upon the *uses* of buildings within prescribed areas. By such means business was kept out of purely residential districts, and heavy or objectionable manufacturing was in turn kept out of business districts. The law also established limitations upon the *area* of the lot permitted to be built upon. These restrictions were designed primarily to protect certain types of residential structures, though the extent of coverage allowed was of necessity influenced by the location and economic usefulness of the property. On the other hand, in the case of *height* restrictions, the zones established were designed to deal principally with office buildings, and in this case also the economic value of the property was the governing factor in the height permitted. The financial district had long suffered from the small sizes of plottages available. As a result, great care was taken in framing the law not to make the height limitations and the setbacks required too burdensome.

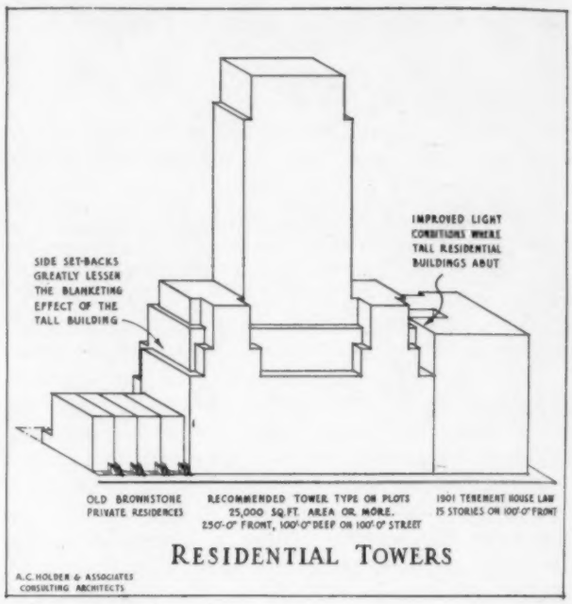
It was originally not thought necessary to differentiate as to heights and setbacks allowed for various types and uses of buildings. The development of neither residential nor loft buildings had been carried to a point where they created special problems of a character to be dealt with under the zoning act. As a result, so far as height and bulk were concerned, the same law governed the construction of office buildings, manufacturing loft buildings and certain classes of residential buildings. The severity of the restrictions as to height and bulk depended solely upon the height or area district in which the property happened to be located. As has already been indicated, the economic value of the land had been the controlling factor in fixing these restrictions. The greatest concern was exercised with regard to high value of land. It was deemed necessary to permit such heights as would not cause hardship or loss to the owners of valuable land. The tendency was therefore to scale up the allowable limitation generally so as not to appear to discriminate unduly against land in less desirable sections. The tendency of all land values to advance toward the economic limit set by ultimate permitted use was unforeseen. Attention was focused upon the expected uses. Because the resultant developments were expected to be desirable, no differentiation was made which related the size and shape of the building to other probable uses. The possibility had apparently been overlooked that certain other uses for buildings of great height and bulk might create problems capable of threatening the health and efficiency of the community.

Residential Buildings. It was originally supposed that the height and bulk of residential buildings were controlled in the main by the state tenement house act, but it was ultimately discovered that by definition the tenement house act governed only the construction of buildings where three or more families did their cooking. One had only to pledge the tenants of the building not to cook, and the building was exempted from the more stringent requirements for court sizes, light, and air, and even exits imposed by the tenement house law.

Under the influence of natural economic pressure, the exterior aspects of a certain class of fireproof residential buildings therefore began to take on the aspect of the well known office skyscraper of the financial district. Now this was all very well at the


HIGH WALL ON SIDE LOT LINE BLANKETS ADJOINING PROPERTY AND DEPENDS ON IT FOR LIGHT
UNDESIRABLE LIGHT CONDITIONS CREATED BY BOTH ZONING LAW AND 1901 TENEMENT HOUSE LAW
OLD BROWNSTONE PRIVATE RESIDENCES
ZONING LAW TOWER ON 125'-0" FRONTAGE STREET 100'-0" WIDE
1901 TENEMENT HOUSE LAW 15 STORIES ON 100'-0" FRONT
RESIDENTIAL TOWERS
A.C. HOLDEN & ASSOCIATES CONSULTING ARCHITECTS

The tower in the center is made possible by the failure of the tenement house law of 1901 to provide limitations upon the height of residential buildings. The root of the trouble lies in an unenforceable definition of a tenement house. As land values increase, residential buildings tend to expand to the limits set by the zoning law, which permits the blanketing of adjoining properties, and insufficient light courts, and creates undesirable living conditions.


SIDE SET-BACKS GREATLY LESSEN THE BLANKETING EFFECT OF THE TALL BUILDING
IMPROVED LIGHT CONDITIONS WHERE TALL RESIDENTIAL BUILDINGS ABUT
OLD BROWNSTONE PRIVATE RESIDENCES
RECOMMENDED TOWER TYPE ON PLOTS 25,000 SQ. FT. AREA OR MORE. 250'-0" FRONT, 100'-0" DEEP ON 100'-0" STREET
1901 TENEMENT HOUSE LAW 15 STORIES ON 100'-0" FRONT
RESIDENTIAL TOWERS
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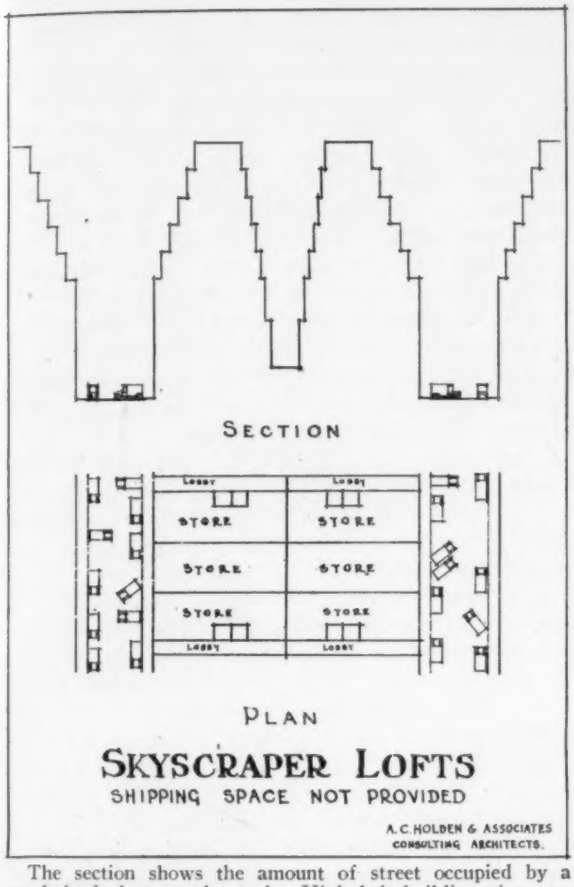
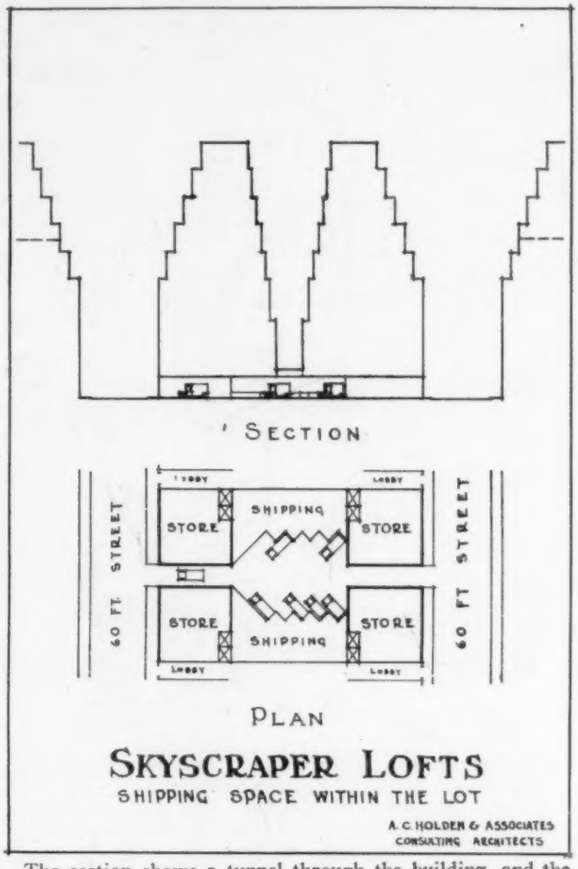
The tower in the center, according to the recommendations made, will be permitted only when 25,000 square feet or more are assembled in one plot. The mass of the building will be required to set back from the lot line with a height 5 feet greater than the width of the street on which the building fronts. This feature is a protection to the adjoining 15-story tenement (1901 law) on the corner, as well as to the old fashioned 4-story brownstone fronts.

start. The first skyscraper residential building in a block meant exceptionally good light and air for its own tenants, but it meant shadows and dark rooms for adjoining property owners. Where, however, skyscraper residential buildings ultimately become built up closely together, it means that the one damages the other. It means that although the upper stories may remain extremely desirable, the lower floors become not only undesirable but actually unhealthful for the reason that no sunlight can penetrate the excessively deep courts. While such courts may be quite possible in office buildings, which are occupied on the average eight hours during the day, there is a very different story to tell when the buildings are occupied both day and night. Doctors are united in their contention that all living quarters should be exposed during at least a portion of the day to the play of direct sunlight. The Committee on the Regional Plan of New York and Environs has carefully studied the question of sunlight penetration into living quarters and reports that it should be possible to determine minimum requirements for courts and window sizes by the minimum healthful standards of sunlight penetration. It is therefore a sound public health policy to impose restrictions as to height and bulk which are more stringent in the case of residential than in the case of office buildings. Such a policy, moreover, is to be recommended because it is an equitable protection to adjoining property owners. The great impetus that the development of apartment hotels and hotel buildings has attained today makes it imperative that height and bulk requirements should be immediately revised to differentiate between residental and office buildings. The forthcoming recommendations for the revision of the state tenement house law will mark the first step in the direction of such differentiation.

Manufacturing and Loft Buildings. Residential buildings, however, are not the only structures which because of their use call for special restrictions upon height and bulk. In all of the outcry today against congestion, more is being said about traffic than we have ever heard before. The work that is done in buildings has perhaps as much to do with the origination of traffic as any other single cause. Buildings where manufacturing is done are the direct cause of the origination of much of our heaviest traffic. Our zoning law as at present worded permits loft buildings to be carried to the same heights as office buildings. The modern, high-powered, express freight elevator has made this possible. The law does differentiate as to zones where light manufacturing and heavy manufacturing may be carried on. Where the economic value of the land is great, however, the height and area zones are likely to permit excessive development in height and bulk irrespective of the use to which the building is to be put. As a result of this situation, it is small wonder that in our newest manufacturing sections the streets are inadequate to take care of the traffic. It brings small relief to be able to reflect that it is the economic value of land that has virtually forced the skyscraper type of loft building. The setbacks required by law do, it is true, give far better conditions of light and air than



The section shows the amount of street occupied by a truck backed up to the curb. High loft buildings increase the use of the sidewalks for shipping and produce conditions intolerable for trucking, besides making traffic conditions practically unbearable with trucks backed up in such a way as to occupy approximately half of the street.



The section shows a tunnel through the building, and the plan shows a possible arrangement of special shipping space within the lot. Several building owners might cooperate to allow for shipping space in their interiors. Allowed heights of new loft buildings should bear a fixed relation to the shipping area provided.

have ever been obtainable in lofts before, but the taller buildings create a problem in traffic congestion which is carried at times even to the point of traffic stagnation. At the present time, in manufacturing loft districts, the sidewalks are used as shipping platforms. One line of trucks at each side of the street waiting to receive or discharge goods narrows the space available for the passage of traffic. Such conditions result in constant traffic jams. The price that industry pays for this is higher shipping and transportation costs, which are added directly to the cost of doing business. An amendment to the zoning law which will cut down the permitted height and bulk of manufacturing loft buildings to within the traffic and shipping limitations of the streets is urgently needed. Additional height and bulk may be allowed, however, where adequate trucking space for shipping and driving through, is provided for in the ground stories of the buildings. Where economic pressure has once commenced to operate to increase the height of a type of building up to the point where the traffic conditions created become a menace, the tendency can be checked only by restrictions by law.

Recommendations. Attention should be focused upon the differences in use in our present skyscraper types, and from these differences, with due consideration to safety, public health and the expeditious handling of the city's work, there should be worked out diversified requirements as to height and bulk. For example, in residential sections it is wise to keep walls as far as possible away from interior lot lines. It is wise, also, to require setbacks on the side lot lines, to prevent the erection of a solid row of buildings of excessive height likely to effectively shut off sunlight from buildings located on the northern side of such a row. There is great advantage in retaining openings between buildings through which it is possible for sunlight to penetrate. In the case of residential buildings also, it is both expedient and wise to make the angle for minimum setback requirements sharper than that, for example, required of office buildings.

The policy that may well govern the framers of a revision of the law is to balance, on the one hand, stringent regulation designed to check undesirable tendencies against liberal allowances extended in reward for conformity to sound principles of development. For example, loft and manufacturing buildings, though open to drastic restrictions as to height and bulk, may be permitted both greater bulk in the

The heavy industrial areas of Chicago have naturally followed the radiating railroad lines upon which the city is dependent. The zoning commission has endeavored to preserve adjoining areas available for residence.

lower stories and greater height for the setback stories where complete provision is made inside the buildings for trucking, shipping, and driving through. There are, of course, other matters ripe for consideration in a possible revision of the zoning law. In particular there is the growing need for the reservation of residential zones in proximity to manufacturing and mercantile districts. Problems of this sort have developed since the original passage of the ordinance, and are even at this time beginning to demand attention. By such provisions the city's transportation burden may be in some degree lightened. Most immediate, however, are the considerations which have to do with the proper study and the discovery of the proper interrelation of the factors of height, bulk, and use.

Unrestricted Districts Not Satisfactory. At the present time there are within Manhattan vast districts which so far as modern use is concerned are virtually undeveloped. Nor has there yet been worked out any progressive plan for their development. Until recently it has been assumed that as the city grew industry would expand into these districts, and for this reason most of these localities have been designated upon the city zoning map as "Unrestricted," as to use. On the other hand, there has been a great deal of propaganda recently about "rebuilding the slums." Much that has been said on this subject is purely sentimental. The old buildings in these so-called "slum areas" have certainly fallen into a shocking condition. It is something to stir the deepest sentiments of any true American that his fellow citizens should be asked to pay rent to live in such habitations. The rents that are paid, however, are held at their present levels because of the potential market valuations of the land upon which the old tenements stand. Considered simply as dwellings, a great number of these old tenements are a losing proposition to their owners. The gradual expansion of industry into these old, unrestricted districts has enabled tenement owners to hold their property in spite of rental losses in the hope that ultimate sales at high enough figures will more than pay back the losses during the period when the property was carried as a slum.

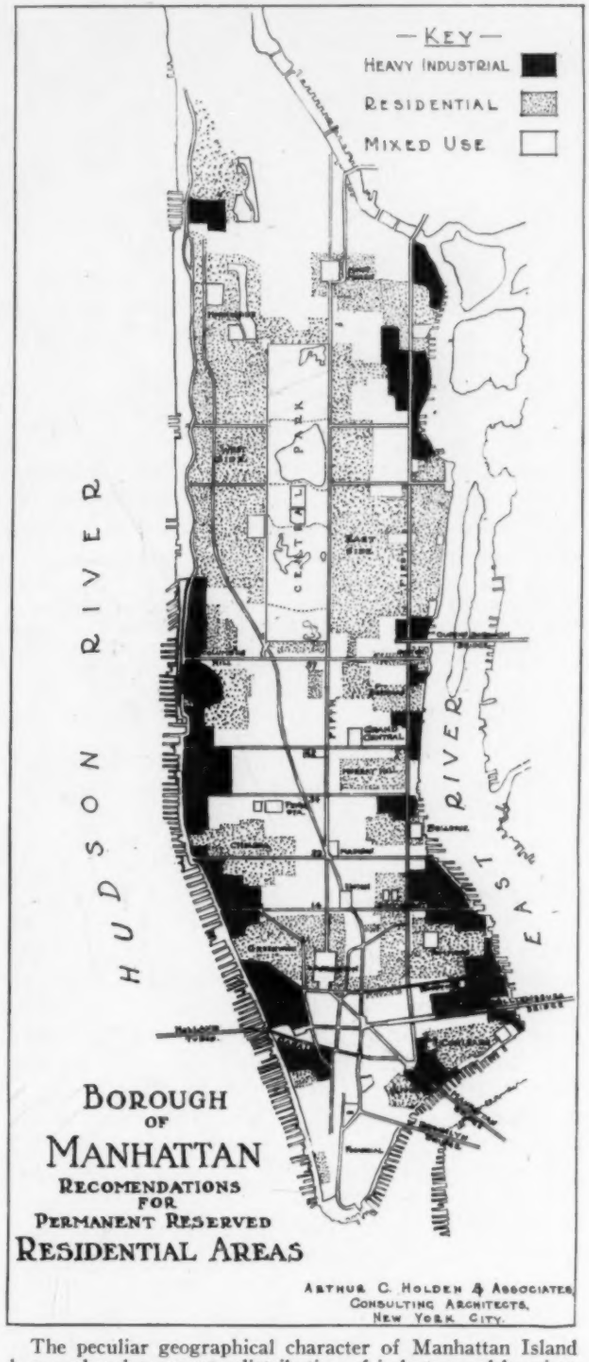
The Case of "San Juan Hill." A typical instance is the course that property in the west sixties of Manhattan has taken. A neglected residential neighborhood back of the New York Central freight yards was allowed to fall into bad repair. The tenements fronting on the streets filled up almost exclusively with negroes. Property adjoining became less desirable for residential purposes. Neglect of repairs made conditions worse. Then came the advent of the automobile and the need for garages and repair and service stations on cheap land. Garages began to invade the district. Then there commenced a movement to assemble large plottages, creating an active market for real estate almost irrespective of the condition of the buildings. This occasioned a general advance in the prices of real estate. Mounting interest charges and taxes put a heavy drain upon the owners, so that in turn less cash was available for maintenance. The effect upon the tenants was higher rents for buildings in worse repair. The effect upon the owners was higher paper value and a retarded market for industrial properties. Today many of the owners are still holding onto property on which the carrying charges exceed the rents, in the hope that a possible future Hudson River bridge in the neighborhood may boost the prices of their real estate. From the point of view of the city, the district has gone from bad to worse. The social and health problems of the neighborhood constitute a tax upon the whole city. So bad were the implications which were connected with the very name of the district, that the attempt has been made to drop the name of "San Juan Hill" and know it as "Columbus Hill." Meanwhile it is neither a residential nor a manufacturing and commercial district, and so far as its present state of development is concerned, it is undesirable from many points of view for either use.

Needs of Industry Vital. Surely it should be possible in any proposed amendment to the zoning law to take better cognizance of the needs of industry, and to set down definite regulations designed to benefit not only industry itself but the general good of the city. It benefits neither industry nor the city to simply write the words "Unrestricted Use" upon the zoning map. In the first place, it does not supply

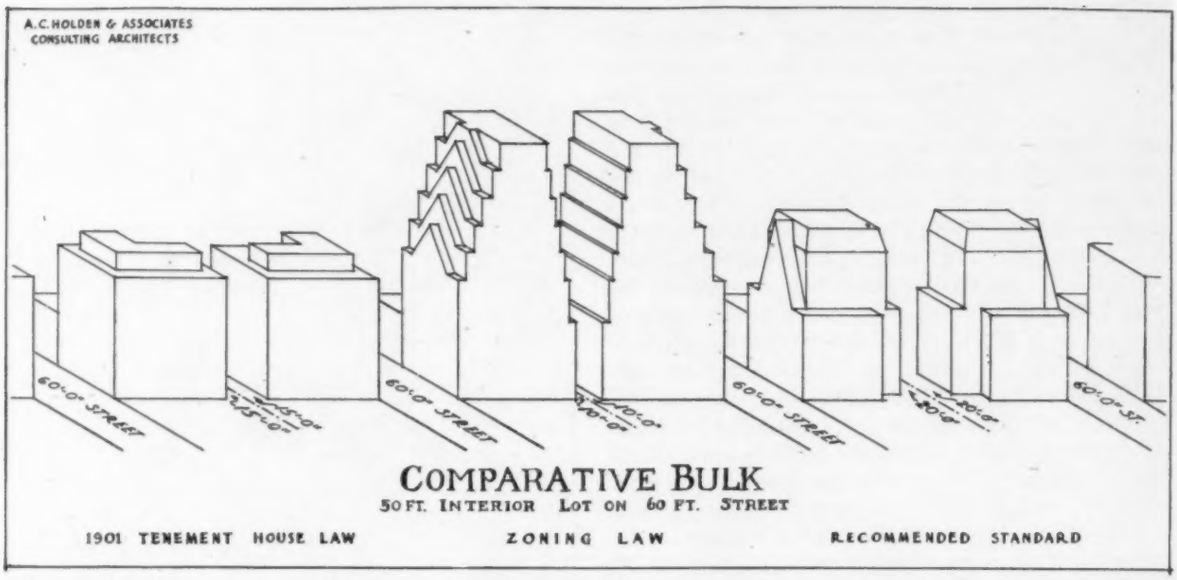
the transportation and shipping needs of modernized industry to expect industry to grow by merely taking over undesirable districts originally laid out for residential needs. Blocks ranging from 600 to 900 feet long and only 200 feet in depth are likely to create difficult problems because of their shape, and when the long frontage is on a 60-foot street, the problem becomes well night insoluble. There is no reason why high prices should be paid for industry on streets which have never been intended for industrial use. In the second place, the prices which industry has been forced to pay for assemblages of plottage have given a speculative stimulus to land values. This has been felt both directly in high prices for industrial plottage and indirectly in high prices for all adjoining property available for housing purposes. As a result, the rents exacted of industrial workers living near the plants have been advanced, with resultant pressure for higher wages.

In the third place, in the search for cheaper homes, industrial workers have been forced into the outlying districts, with the necessity of long periods of travel daily upon expensive transportation systems. There are two primary objections to the long trip to and from work; one is the cost in time to the worker, for which industry pays in the lowered vitality of the worker; the other is the cost in cash which industry pays in the form of higher wages and higher taxes necessitated by the practice of subsidizing the construction and operating costs of transportation systems which are not self-supporting. It is the high rents exacted for old fashioned, sunless, undesirable homes convenient to work that are forcing migration to outlying districts and to the suburbs.

Effect Upon Transportation Problems. This movement has contributed more than any single cause to complicate our transportation problem. There has been much loose talk about the tendency of population to move away from Manhattan, and its desirability, but it is a physical as well as an economic impossibility to transport all of the workers required in an industrialized and commercialized Manhattan to and from the other boroughs both night and morning. The day is not far distant when mandatory provision will be made by the zoning law, restricting for residential purposes districts immediately adjoining areas where manufacturing and commercial and mercantile enterprises are carried on. Furthermore, assessments and taxation must be so equitably adjusted that the assessed values and the resulting taxes upon residential properties will not be disproportionate to the rents that can be charged. It must be borne in mind that land values established at a low level are essential if homes are to be rented at low rates. With the additional interior partitions necessary for privacy and the additional required plumbing, residential construction cost runs higher than the cost of construction for manufacturing and commercial uses. The rental market, however, except in the luxury class of homes, is directly the reverse. Here there is a clear case where it is necessary for zoning regulations to set aside areas where residence values may become stabilized. It should not be necessary to argue here that such a policy will not work hardship upon the owners of



The peculiar geographical character of Manhattan Island has produced an uneven distribution of industry and housing. It is now practically certain that most of the older sections cannot properly be rebuilt for housing unless permanently restricted to residential use. This should not, however, prevent the use of the lower stories for stores or other uses essential to a residential neighborhood. On the accompanying map a preliminary attempt has been made to zone in such a way that residential areas are so distributed with relation to light and heavy industrial areas as to reduce congestion.



(a) The building is not permitted to cover more than 70 per cent of the area of the lot. Front wall may be 1½ times as high as street is wide. Courts are of uniform height throughout. Pent houses may cover 50 per cent of roof area.

(b) The rear yard must be 10 per cent of the depth of the lot. In Manhattan Borough the front wall is in general allowed to be 1½ times as high as the street is wide (in some districts to 1¼ times and in others 2½ times).

(c) The rear yard must be 20 feet deep. The side walls may extend along the lot line for a depth of 60 feet only. Both front and side walls must set back 10 feet above the street height plus 5 feet.

property. It will tend to check the speculative exchange of land in certain sections, but the stabilization of the income should compensate for this.

A consistent zoning policy which includes the proper relation of residential and industrial zones will bring relief to the general problem of congestion. In the first place, the reservation of zones in which heavy traffic is not likely to originate in proximity to zones suffering from heavy traffic is in itself an immediate relief to the traffic pressure in the congested areas. This is of fundamental importance to industry. In the second place, it is no less important to dedicate definitely restricted localities permanently to housing. It is only through the incentive furnished by such a guarantee that improved residential areas of modern standard can be developed. New building in such areas, while perhaps only slightly reducing the population, will nevertheless tend to reduce congestion. Higher buildings with elevators and apartments planned two rooms deep, with garden courts and open spaces, will afford far more healthful accommodations than the present neglected tenement neighborhoods. Finally, every residential area preserved within walking distance of a mercantile, commercial, or manufacturing area reduces the congestion due to transportation, which is one of the worst manifestations of our problems.

The Hope of the Future. There is room of course for great difference of opinion as to what should be done to alleviate the effects of congestion as well as room for differences as to what is reasonably within the possible range of accomplishment. It is strange, however, that so little progress has been made toward getting at the root of the problem. If subway trains are overcrowded the public shouts "build more subways"; if the streets are jammed with automobiles, the public asks for more policemen; if the situation gets worse there is a demand that the sidewalks be cut away and the roadways widened. If rents are high the public expects to have a law be passed setting everything right. The public hasn't the time or the desire to try to find out what is the matter.

The public is not mature enough, even the experts themselves are not yet mature enough, to know that expert advice is valueless unless balanced with an understanding of public need and public policy. In the great overgrown, over-balanced City of New York there is the need today for a great getting together of experts in order that those who are experts in their own line may at least get an understanding of the point of view and of the experience of the others. Our civilization has developed to such a point today that the directing forces have outgrown the mental concept of the individual. By the inter-relation of individuals of different training, however, the group concept can be carried much further, and the forces in our social system with which the individual alone is unable to cope may be controlled and directed by an intelligent group leadership. The solution of the problems will be dependent on such coöperation.

Perhaps the problem of the further development of city zoning ordinances is one of the foremost that has arisen to challenge the capacity of the individual expert. Bound up with it is the key to the current which sways the whole course of city growth and city life. It is not a problem which can be left with a bunch of theorists to be toyed with.

BUSINESS AND FINANCE

THE ARCHITECT AND BUILDING FINANCE

BY

C. STANLEY TAYLOR

THE interesting changes which have taken place in the practice of architecture within the past decade have established the profession in an economic position far more comprehensive and important than is at first realized. A very large proportion of the building activity of this country, now and in the years to come, takes on the nature of a business investment. This is obviously true in the case of structures which are built for the purpose of profitable resale or to return income on an investment. It has also become definitely true in the case of buildings that are constructed to house industrial and commercial enterprises. Factory buildings, warehouses and various types of commercial structures have become extremely important tools of industry. Their design and construction exercise a powerful influence on the profits of the businesses operated within them. If the buildings are inefficiently designed, it means that operation and handling costs may often mount to a figure which eliminates profit. If they are not well constructed, it means that maintenance and depreciation costs may so offset profits as to cause red ink figures in the annual statements.

Architecture's Advertising Value

Following the examples of leading industrial and commercial organizations, practically all business men are giving today much more serious consideration to the structures which they build for their own use. Accountants are introducing construction and building maintenance costs seriously into their figures. The appraisals of such enterprises made for purposes of financing through stock and bond issues give a prominent position to buildings as important assets of the business. In the same manner these buildings have taken their place in what might be termed the "institutional" advertising programs, particularly of the larger industries. Well designed structures are definitely featured as a part of their general newspaper and magazine advertising. Advantage is taken of strategic locations for the designing of factory buildings which will impress the passing public. Thus architecture is being gradually woven into the fabric of commerce and industry, assuming very important proportions as compared to its place but a few years ago.

The housing movement, which is carrying thousands of families into apartment buildings and apartment hotels, calls for architectural service which involves not only skillful and efficient planning, but the designing of exteriors which will attract the interest of tenants. Stores and shops, theaters,—in fact almost all structures in which business enterprises of any nature are operated,—are demanding architectural design based on higher standards of business operation and of living environment. Even in the construction of modern homes, both small and large, this business aspect of architectural practice enters. There is a strong trend today on the part of the prospective home builder to give much thought to his investment. In days not long past the building of a house was more or less dissociated from business consideration. There was little thought given to resale or financing values. But today it has become recognized that the home is logically a part of one's estate, and often a very important part.

The Architect's Responsibilities

If, then, we take the term "building finance" in its broader meaning to include not only mortgage financing but also the sales or asset valuation of a structure, it becomes immediately apparent that the architect is a powerful factor in his business relationship with the investment. It is often within the power of the architect to establish the failure or success of a building in accordance with the plans he draws. His specifications will tell the story of reasonable or excessive maintenance and depreciation charges. His presentation of the project may have a powerful influence on its financing. It is for these reasons that every architect, even though his practice may be restricted to residential work, should give serious consideration to his place and his responsibility in relation to the owner's investment. An interesting fact is to be noted in studying the programs of many architectural organizations within the past few years. Almost without exception those offices which have been most successful are those offices in which there exists a definite measure of appreciation of the business aspects of the building projects entrusted to them. Conversely, we find organizations which have depended entirely on designing skill passing gradually out of the picture, while good, profitable work follows the line of least resistance from the practical point of view of the average business man. These statements do not mean that the architect must become completely businesslike in his administration, nor do they mean in any way a sacrifice of architectural integrity or belittling of good design. The ideal situation is to be found when the two elements are combined, to the end that structures of fine appearance and a high degree of efficiency of purpose may be created.

There are two ways in which the architect may establish and hold his contact with the important

function of building finance, or in other words, with the business side of any building project. The first way is to gain for himself through observation and study a general knowledge of the various elements which create successful financing and operation in the building field. The second way is to understand and appreciate the contribution which can be made by experts of various types who, in a consulting capacity, will assist in making plans successful. If we examine today a building which is undoubtedly achieving its purpose by operating successfully from the owner's point of view, we will almost always discover that a happy combination of brains and experience has been involved. We shall find either that the building was designed by an architect who has had sufficient experience in the type to know its business problems and to meet them successfully, or we shall find that either through the owner's or the architect's insistence someone has been brought in who could and did contribute the necessary knowledge of operation to establish the project in a successful manner.

The Architect's Business Position

Many architects probably do not realize that a few years ago,—perhaps 10 or 12 years back,—the profession went through a very serious and critical period. In a sense its ultimate place in the American business world hung in the balance. The question then was,—would the architect assume his rightful position in relation to building projects, or would he be but a hired designer, paid by owners and contractors to develop simply pictures in accordance with specific instructions? A great many of the larger architectural offices and also many of the smaller units in the profession responded in a most interesting way to this situation,—sufficiently to swing the scales in a most favorable manner. There are some who will question this statement and who will refuse to recognize that the profession ever faced such a critical situation. To these we can only suggest consideration of two or three important facts.

The Architect as Business Adviser

Almost all of the leading architectural offices today have a full appreciation of the business aspects of the projects on their boards. This is true even to the point of finding individuals, in many of these offices, whose sole work has to do with business administration,—not only of the office itself but of the projects of clients. There exists today a very close relationship between architects and bankers or other sources of mortgage loans and between architects and building managers, real estate experts and other types of consultants who contribute to the economic design of a structure. The architect today stands in a very different light in the eyes of the average business man. He is not only a designer but he is often recognized as a sound advisory source. The questions which are asked in the average architectural office today pertain much more to the business than to the æsthetic requirements. These questions are broader in their range,—they delve into profit making or operating functions to a far greater degree than ever.

Cost Estimates and Finance

In connection with many types of building operations, the first requirement demanded of the architect is the preparation of sketch plans and outline specifications of such a nature that they may materially assist in financing. Very often this is not only ordinary senior financing but has to do with bond issues and other types of public financing on a large scale. It is very often the case that general financing agreements are required on large operations even before land is actually purchased. The architect's function here is to provide sketch plans which will show what kind of a building can be built on the particular site in question, and from which tentative operating and income schedules can be developed sufficiently to justify a preliminary financing commitment. At this point there enters one of the most important functions which the architect can possibly perform in connection with the financing of a building project. This is the function of preliminary cost estimating, and it is here that the architect's great responsibility begins, because at this point a countless number of building projects have been started in the wrong direction. Innumerable instances can be given where building committees have been misled by architects' optimism in regard to ultimate costs. Case after case can be cited where financing negotiations have fallen through because preliminary cost determinations were made in a vague or fallacious manner. To erroneous preliminary cost estimates there may be charged the loss of many a good project which has never passed the preliminary stages in the architect's office, because of a false start. It is to be remembered, after all, that most individual or committee administrations of a building project are being operated in a thoroughly practical manner by business men. Almost without exception, clients are willing to face facts if they are presented in a dependable and sincere manner. What clients do not like is to face facts after the actual operations are under way or nearly complete,—that is, if the facts prove original estimates to have been far too low.

Aspects of Preliminary Cost Figures

Careful observation of a great many building projects seems to prove that it is quite possible to make preliminary estimates which are not far from the ultimate truth. It does not matter if the building so developed is smaller than the client had hoped to obtain under his budget, nor does it matter if he cannot go into certain luxurious types of materials, finishes or equipment. What really does matter is that he shall know approximately what he can get for a given amount of money, or approximately what the building he wants will cost. He can change his ideas or increase his budget if he finds that it is necessary, but after he has plunged into the invest-

ment and is coming to the finishing stages, if he discovers a great discrepancy between the estimate and the actual cost, he often finds himself in very hot water. He finds that he cannot go back to his mortgage financing sources and increase his loan. He often has no additional capital of his own, nor can he obtain it. What then usually happens is one of two things. Either the project goes under foreclosure and is finished by someone else, or it becomes necessary to greatly cheapen the finishing and equipment of the building, which is very unfortunate. We have today many examples of well designed and well built structures which have been forced to cheapness in the finishing stages because of failure to properly estimate and budget building costs. Consequently, these buildings are operating under unnecessarily high maintenance costs and are suffering from a degree of visible depreciation and shoddiness which directly affects renting both in the size of the income and in the percentage of vacancies.

Here is a situation which often is charged to the architect's failure to obtain proper preliminary estimates,—and the charge is often fair, because this cost is perhaps unfortunately often a part of the architect's responsibility. Of course, it is not a direct financial responsibility, because the architect in no sense guarantees the cost of the building, but it is to be noted that where costs greatly exceed estimates, the client will hold this fact against the architect forever.

Reliable Cost Data Essential

This is not the place to discuss methods of estimating costs, particularly preliminary costs. Articles will appear from time to time in this section of THE ARCHITECTURAL FORUM covering this subject from a number of important practical angles. It is sufficient to say here that experience has proved that preliminary estimates of a fairly dependable nature may be had if sufficient care is exercised to determine costs by correct comparisons and through sound sources of information. Obviously, the architect should not shun a discussion of costs, nor should he in any way attempt to gracefully evade this subject. On the other hand, he should be the first to insist upon such a determination and the first to bring his client squarely face to face with this practical side of his project. We have never yet met a client who broke off relationship or indicated an unpleasant attitude because the architect brought him face to face with the truth before his money was in danger. We have seen thousands of cases of the reversed situation,—all of which proves that one of the most important relationships of the architect to this question of building finance is that of cost estimating.

Presentation of Preliminary Sketches

The actual physical presentation of sketch plans is highly important. The first impression which a banker or an investor gains in relation to a new building project is regarding the location and general purpose of the building, but the most powerful impression he gains is its first visual interpretation, which, of course, must be from the sketch plans prepared by the architect. Owners themselves are not always aware of this fact, and the architect should clearly indicate to the owner the importance of proper presentation. Naturally, the larger the project or the more involved its financing, the more carefully should this presentation be made, and here again the architect plays an important role in building finance.

Thus far there has been no indication that the architect must become a past master of building finance. Of course, if he reaches a point where he establishes financial connections in which he can actually aid clients in obtaining building and mortgage loans or in the promotion of a project, it is obvious that he can benefit materially. On the other hand, if he will only discharge the functions which come naturally within the scope of his work, fitting them into the business needs of the project, he will have accomplished all that is necessary.

Specifications and Costs

In this connection we naturally come to a consideration of specifications. The selection of building materials and equipment is of tremendous importance in relation to the business success of the new building, as has already been indicated. The building field of today offers such a tremendous scope for selection that even in the less expensive types of construction it is quite possible to incorporate materials and equipment which will function in a manner consistent with successful operation. As buildings have assumed a more important position in the economic structure, it is but natural that their span of useful life should have been materially lengthened. Construction costs are so high and individual projects are often so large that short-term investments have become impossible in this field. At the same time, even as a chain is as strong only as its weakest link, so a building is only as good and will exist only as long as the poorest major materials and equipment which are incorporated in it. Consequently, the architect must become even to a greater degree than he is, an exponent of the use of good materials and equipment. He must be a demonstrator of the fallacy of cheapness in construction,—and all from the business point of view. This is another way in which he can render a tremendously valuable service in relation to building finance and make an equally valuable economic contribution.

If the architect of today will do these things in conjunction with good designing, he will not only fulfill his true function, but he will have discharged his responsibility to the owner in a manner which will earn many tangible rewards.

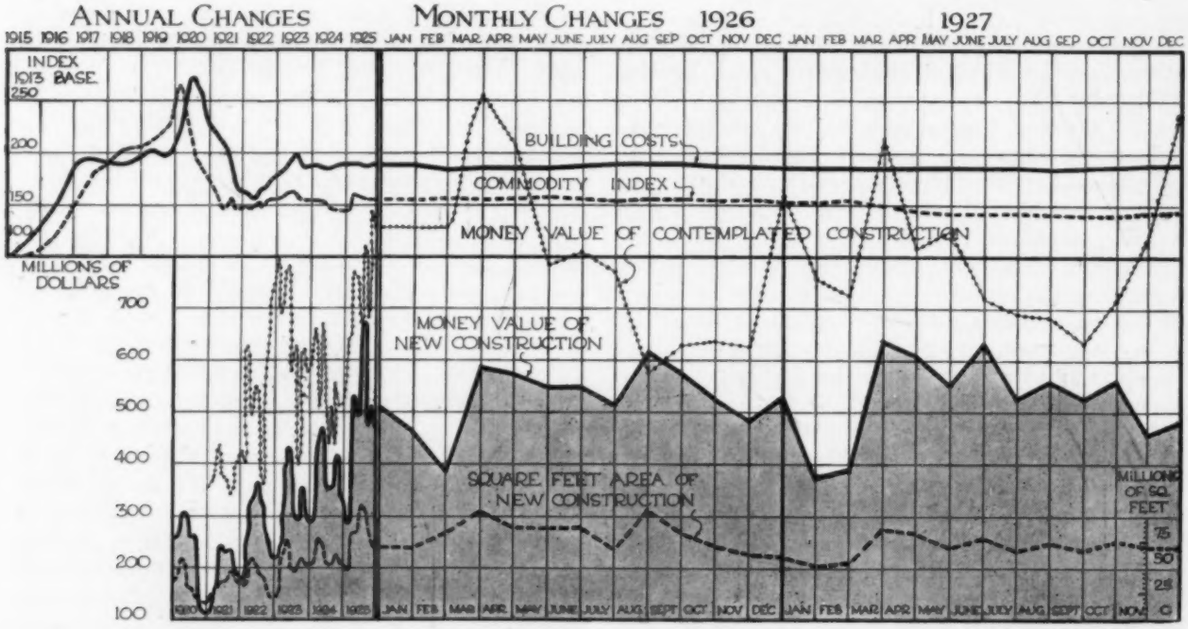
THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

NOW that the figures are available for the year 1927, it is interesting to learn, according to the F. W. Dodge Corporation, that last year was the second best year in the construction industry. For the entire country the figures given for total 1927 construction are estimated at a little over $6,800,000,000, which is about 30 per cent less than for the year 1926. The chart included here presents in graphic form the history of building activity since 1920. The years 1926 and 1927 are shown in monthly totals, both in money value and in physical volume of construction as measured by square feet of new floor area. One very interesting detail as indicated by the chart is that the month of December recorded a total plan filing of unusual proportions. The plans filed in the month of December indicate contemplated construction totaling $988,915,100. These figures show a gain of 20 per cent over the amount reported in November, 1927, and 9 per cent over the amount reported in December of 1926. All indications point to a considerable volume of contract letting to take place early in the year 1928,—thus starting off the year as predicted in THE FORUM Forecast for 1928, which indicates a year at least as active as 1927, with totals perhaps slightly greater.

The contemplated construction is well worth analyzing to find out in what territories this early activity may be anticipated. The new work contemplated in New York state and northern New Jersey in December showed a gain of 68 per cent over the total of November, 1927, but a loss of 7 per cent from December, 1926. In the New England States there was a loss of 12 per cent from the amount reported in November, but a gain of 25 per cent over the corresponding month of last year. Evidently, there is to be greater building activity in the New England district in 1928 than during 1927. In the Middle Atlantic States there is shown an increase of 51 per cent over the amount reported in December, 1926, indicating a considerable increase in building activity. The Pittsburgh district showed somewhat less than in December, 1926. The Northwest shows a drop of 23 per cent from December of 1926. The Southeastern States show a drop of 11 per cent, and Texas a drop of 8 per cent. The year promises to be a good one for architects. In a great many offices there has been a slacking off over the ending period of the year, but the middle of January, when this review was written, already presented indications of renewed designing activity in most sections.

In many areas throughout the country there is evidently to be activity by speculative builders.



THESE various important factors of change in the building situation are recorded in the chart given here: (1) *Building Costs.* This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) *Commodity Index.* Index figure determined by the United States Department of Labor. (3) *Money Value of Contemplated Construction.* Value of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corp., and *Engineering News-Record.* (4) *Money Value of New Construction.* Total valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) *Square Foot Area of New Construction.* The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.

ARCHITECTS, COSTS AND CONTRACTORS

BY
MORTON C. TUTTLE
PRESIDENT, MORTON C. TUTTLE CO., BOSTON

IT is commonly assumed, almost as an axiom, that the final cost of any building operation will of necessity be greater than the first estimates promise. This cost obviously concerns the buyer more than anyone else, yet the procedure conventionally followed in construction work may leave him with less control of his expenditures than anyone connected with his enterprise. He finds his function virtually reduced to that of trusting others and paying the bills which they present. He entrusts the investment of his building funds to those he believes more expert than he is in the technical problems involved. The basic cause of an owner's inability to control the cost of building is discoverable in the fact that the erection of any structure today involves complexities of design and equipment,—and hence the employment of a number and variety of specializing designers, contractors, and workmen such as were not dreamed of even 25 years ago. The immediate cause is attributable to a conservative disposition on the part even of able business men, which leads them to attempt to meet the complex building requirements of the present by the direct and simple means which sufficed a generation or more ago.

There are two important aspects to every construction design: first, the aspect of utility; second, the aspect of cost. Distinct though these are, their interrelations must never be lost sight of. An office building may be designed so as to satisfy every requirement of utility. Yet, if the cost of the finished building is excessive, the necessity for fixing rents high enough to insure an adequate return on the investment may disastrously reduce the tenancy of the accommodations offered. If mill, or warehouse, or factory represents excessive expenditure of capital, the inevitable overhead charges for the interest on the investment may seriously impair operating profits, or even reduce them to the vanishing point. Clearly, then, a design which has been drawn with theoretical utility primarily in mind, and without strict consideration of the cost of all the individual elements whose sum will constitute the total cost of the finished structure, must be viewed as essentially unsatisfactory. It is not sufficient to know that this design provides for a usable building. The scheme is not adequate if, by substituting other details and other materials for those specified, an equally excellent structure may be obtained in less time for less money. If cost is a vital concern, and if it must be controlled, then, obviously, someone fully competent in cost matters should be constantly in contact with every step in the development of any design whose fulfillment in structural form involves cost. Unfortunately, however, men who are competent to direct the designing and at the same time to check the cost of each phase of its progress are extremely few. And the more the nature of the design is such as to appeal primarily to the designer's creative imagination, just so much the more are considerations of cost likely to be overlooked.

Protecting the Owner's Expenditure. It is fairly evident that the present procedure in undertaking a building operation of any magnitude is likely to involve an owner in avoidable expenditures, and to cause him eventual dissatisfaction or even keen disappointment. It is possible, however, for the owner to be so informed in advance as to the cost of developing each of several schemes that he may be able to proceed with complete assurance that the proposed undertaking will not require expenditures beyond those which, in the beginning, he has accepted as satisfactory and reasonable. This may be accomplished through the employment of an expert in construction costs, either a member of the architect's staff or a consulting expert. In either event such an expert will be a man of broad training, who has spent years in direct contact with actual building operations and who has devoted himself to calculating both the practical utility and the cost—in time, labor, and materials—of every element of building.

Complete Preliminary Estimates Necessary. Called into consultation at the inception of a building problem, such an architectural cost expert should be able, after consultation with the owner, to prepare a number of sketch plans of buildings of various types, any one of which would satisfy the general requirements outlined. He should be prepared, further, to render an accurate estimate of the cost of carrying out each of these plans, and to select the best for presentation to the owner with the estimate in sufficient detail so that the owner may judge, not only the probable cost of the whole, but the cost of each of the elements. Such an analyzed estimate makes it possible for the owner to weigh the importance of each feature in terms of its cost, and to retain this feature or to discard that, according to his judgment as to its relative dispensability. The plan thus generally outlined, estimated, and finally approved serves to establish a budget by which the detailed development of the design can be controlled. The cost expert should check every step in the progress of the work and safeguard against such departures from the plan as would increase the cost.

Architects who do not have trained cost experts in their own organizations find it advisable to have the collaboration of a consulting cost expert. They find that his services relieve them of a heavy load of responsibility, supply them at first hand with otherwise almost unobtainable practical information, and, by constantly and clearly defining the limits of

the creative endeavor, stimulate concentration upon the essentials of excellence in both structural and decorative design. Furthermore, in the end, a building plan developed in conformity with a preliminary budget, for whose application the cost expert is accountable, is pretty certain to present no necessity for those hasty and disfiguring last-minute modifications and eliminations which harrow the souls of all such designers as take worthy pride in their work. A concrete example is that of a library building which was completed with a saving of $35,000 without sacrificing beauty of design, because of the collaboration of designer and cost expert.

It may be argued, at this point, that the cost expert is likely to insist on so reducing the design to its barest outlines that its character, beauty or effectiveness will be lost. The opposite may well be the case, as the savings suggested by the cost expert may easily go far toward making possible various elaborations calculated to enhance the attractiveness of the structure. If they do not, they will result in no further scaling down of purely decorative items than is properly demanded by the suitability of the building to the class of service which it is to render. Once final plans have been completed by the collaboration of designer and cost expert, they should be accompanied by an exact and accurate estimate of cost for every item of materials and labor which will enter into the building, together with an estimate of the time which should be allowed for completing each step in the building program.

Selecting the Contractor. The next step is the selection of the contractor best qualified to erect the building. The general contractor must possess a wide knowledge of material markets; he must know intimately the reputations of the sub-contractors in various lines; he must know the prices and the values of different classes of workmanship and different brands of materials. This knowledge of the general contractor may be used in either one of two ways, depending upon the form of business arrangement made with him. If he is put into competition with other contractors, his interest is to produce, at the lowest cost, a building which will pass inspection.

Competitive Bids. The theory governing the competitive method of selecting the general contractor is that this individual will, in so far as possible, safeguard his own interests, and that the architect or engineer will safeguard the interests of the owner. Here is a conflict of interests which is necessarily unfortunate. It sets the contractor on the watch for every possible flaw in the architect's specifications, and encourages him to make high charges for every departure from them which changes or enlarges the original plan. And, worst of all, it drives the contractor to do all his buying, both of materials and of sub-contract service, on the basis of *price* rather than of *value*. The general contractor, today, is by no means merely a kind of foreman mechanic who directs the work of his own employes. In the erection of a modern office building, for example, the general contractor's direct payrolls average hardly more than 15 per cent of the total cost of the structure. The remaining 85 per cent of this cost is absorbed in purchases from others—purchases which include rentals of machinery, materials, and labor through the medium of sub-contractors. To subject the general contractor to the pressure of competition is, therefore, to force him into making 85 per cent of his commitments in the cheapest available labor and materials markets. And this procedure inevitably relaxes his control over the quality of his purchases and over his method of making them. In the construction of an office building the services of some 30 different sub-contractors are employed and of a greater number of dealers in materials. Now, clearly, the facilities, or the skill, or the business ethics of no ten plumbing concerns will be quite the same,—or even equivalent. No ten different painting contractors will deliver equally satisfactory workmanship and supply equally reliable materials. One plastering concern will do a far better piece of plastering than almost any other in its locality. And in the business of building, as in other lines of business, the services of the expert are seldom obtainable at as low a figure as those of the incompetent.

It is poor policy to place a general contractor in a position where his knowledge and ability must be employed for the most part in safeguarding his own interests rather than those of his employer. Accordingly, he should be tentatively or fully engaged by the owner at the same time that the architect or engineer is employed. Under such circumstances it should be understood that he is to work *with* the architect,—concerning himself, first, with matters of cost, as they develop in the design proper; next, with purchasing; and lastly, with the conduct of construction. Thus engaged, the contractor will often be found to serve as a reliable cost expert, and in any event as so efficient a supervisor of costs that through his agency the owner may from first to last feel confident of controlling his expenditures. So long as the general contractor is not subjected to the pressure of competition, he can work in this way; but, as soon as competition is forced upon him, his interest shifts, and such knowledge as he possesses is reserved for his own protection, not for that of his employer. We submit therefore,—and here engineers and architects are pretty much in agreement,—that if competition is to be applied in building, it should be resorted to, not among the general contractors,—who are to be the buyers of plumbing, and painting, and steel work,—but directly among the plumbers and painters and steel men. Only in the latter case is it possible to appraise the real value of the service offered in relation to the prices asked, and to determine whether the proffered figure is really as attractive as it seems.

It may, of course, be argued at this point that the architect's specifications, by which contractor and sub-contractor alike are bound, will stipulate the

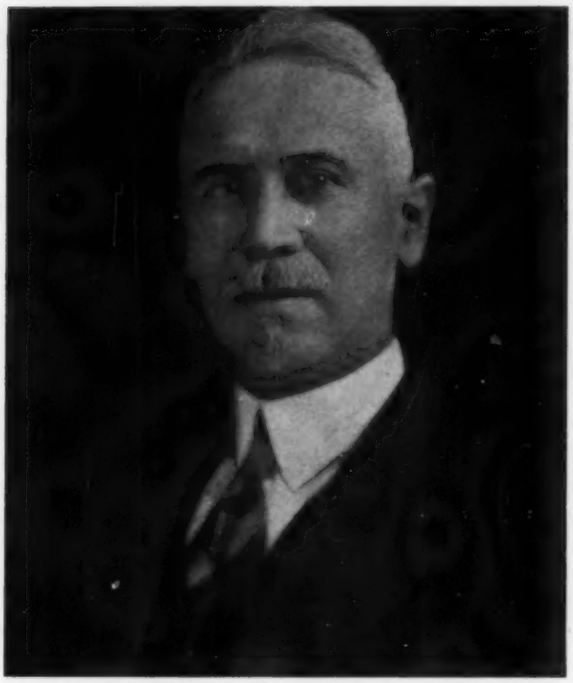
exact character of the work to be performed and the quality to be achieved; and that careful inspection should suffice to insure adequate fulfillment of these specifications. Anyone possessing a sense of humor might delight in following this optimistic theory in its application to a surgical operation, to the painting of a portrait, the composing of a piece of music, or even to the humble yet subtly exacting process of making an apple pie. In his inner consciousness, every intelligent person is aware that the one chance of obtaining good work is to entrust a task to the competent. Inspection offers no substitute for honesty and ability. Granting that the contractor has been employed as an agent and not as an enemy, he will, when plans are completed, proceed to gather the bids of sub-contractors and material dealers. He will submit these bids with his recommendations to the architect, who in turn, after consultation with the owner, will determine which proposals are the most satisfactory. This procedure will enable those in command to make selection, not solely on the basis of price, but on the basis of value to be expected.

It will be the contractor's responsibility to organize finally all the interrelated functions of the building undertaking, to set up his organization, to arrange time, material and labor schedules, and with the least possible delay to get the work under way. If he performs his task as he should, he will keep the architect and owner constantly and reliably informed of the progress of operations, from the standpoint of actual time and money expenditures in comparison with previously submitted schedules. If changes in plans are ordered, he will make the necessary revisions in his schedules, and advise as to their bearing upon original time and expense estimates.

Knowing from start to finish the progress of operations, the owner will find himself able to control every aspect of his undertaking through the ablest collaborators, and, as completion draws near, to plan with complete confidence on the utilization of the new construction. If the work develops savings over the estimates, it is to his advantage; if conditions arise which necessitate expansions or other considerable alterations in the original plan, he pays only what these cost and with a full understanding of the situation. And in the end there will be delivered to him precisely the kind of building which he looked forward to owning.

Photo. P. J. Weber

Administration Building, Central Maine Power Co., Augusta
Joseph D. Leland & Company, Architects
A Building Erected by the Morton C. Tuttle Co. Under the System Outlined in This Article



WILLIAM J. SAYWARD

WILLIAM J. SAYWARD was born in Woodstock, Vt., in 1875. Whatever he may have been when he first descended the rugged slopes of the old Green Mountains, whatever grimness or dourness of that forbidding soil may have adhered, today we know him, after he has enjoyed 14 years of Georgia sunshine, as a pleasant, genial man,—a man not self-seeking; as enduringly dependable as the granite of his native hills; a man so rigorously fair-minded that he has been known to regret the salary he asked and received from his first employer, because he "couldn't have been worth it." He was graduated in civil engineering from the University of Vermont in 1897, and in architecture from the Massachusetts Institute of Technology in 1901. His early training was gained in the office of McKim, Mead & White, where he remained until 1908, leaving them to study in Europe. On his return he was, until 1913, a member of the firm of Wilcox & Sayward of Seattle. In 1913 he came to Atlanta to form with Mr. Edwards the present firm of Edwards & Sayward. There is not space allotted to make a comprehensive list of the work of this active firm, but the Girls' Senior High School of Atlanta, the Columbia Seminary buildings at Decatur, Ga., and the auditorium building of the University of Florida can be mentioned as typical.

Mr. Sayward has taken a very active part in the development of the North Georgia Chapter of the American Institute of Architects, of which he was president in 1917 and 1918. He is now regional director for the Southeastern States of the A. I. A., and was elected a Fellow of the Institute in 1926.

HAL. F. HENTZ.

HAL F. HENTZ

NO firm of architects in the South has done more to advance taste in architectural design than has that of which the subject of this sketch is the senior member. Born in Florida in 1884, Mr. Hentz received his early training in the schools of that state. Naturally his collegiate course was undertaken in a Southern institution, Emory University, in Georgia. For his professional course, however, his eyes turned to Columbia and from there on to Paris, where he spent 1908 in the Atelier Julien. His early professional experience was gained in the office of Kirby, Petit & Greene of New York.

It was in Columbia, however, that acquaintances were formed which were to ripen into the partnership of later years. The partnership of Hentz & Reid was established in 1909, the two young men returning to the South where they opened an office at Macon, Ga. At this time, the dean of architectural practice in the immediate section was G. L. Norman, of Atlanta, who became attracted by the capacity of the young firm, and an alliance was formed under the name of Norman, Hentz & Reid. Upon the death of Mr. Norman the former firm name was resumed, but this was soon enlarged to include Rudolph S. Adler. As Hentz, Reid & Adler, the firm's practice increased in size and character. The death of Mr. Reid in 1927 caused a further readjustment of the firm as Hentz, Adler & Schutze. Mr. Hentz' personal qualities and ideals have compelled the recognition of his fellows so that he has twice been called upon to serve as president of the Georgia Chapter, A. I. A., which office he now holds.

WILLIAM J. SAYWARD.

THE ORGANIZATION AND PROCEDURE OF ALLIED ARCHITECTS

THE ALLIED ARCHITECTS ASSOCIATION OF LOS ANGELES

BY
EDWIN BERGSTROM, PRESIDENT

Editor's Note. In ever-increasing numbers we find public buildings and others designed by the "Allied Architects" or the "Associated Architects." The interest evoked by the results achieved naturally has a corollary in the curiosity in regard to the organization and procedure of the associations. Architects generally have evinced interest in this form of architectural organization, and public spirited leaders have seen in them an opportunity for service. New associations are being formed, and there is a likelihood of still further steps in this direction.

We are privileged to give in some detail the salient features of one of the most successful organizations of this kind, the Allied Architects Association of Los Angeles. We plan to present in a later issue the correspondingly interesting features of several other outstanding organizations.

THE Allied Architects Association of Los Angeles was founded nearly seven years ago by 32 licensed architects associating for the purpose of providing architectural service for buildings built with the proceeds of public tax money.

The plan, the idea, the ideal of this organization were perhaps best expressed in the statement published by the Board of Directors in July, 1921:

"These architects believe that they can subordinate and submerge their individual interests, to the end that they shall collectively as allies and coworkers offer the civil authorities a method of securing the best of architecture in public structures at no greater cost to those authorities for their collective services than would be paid to an individual architect, and with the utmost assurance that the buildings would be built for the least possible cost.

"The idea is to give collective service,—the ideal is to achieve thereby an adequate expression of the art of architecture in our public structures. The idea and the ideal are expressed in the by-laws of the Association: 'The paramount purposes of this Association are to advance the art of architecture, and by the professional coöperation and collaboration of all its members to secure for and to provide municipal, county, state and national governments with the highest and best expression of the art of architecture in the designing, planning and construction of public buildings, structures and improvements and at the least possible cost. It is not intended that this Association shall accept or perform architectural services for private individuals, firms, or corporations; but this shall not be deemed to prevent the Association from rendering such services to its members.'

Rights of Members. "The Association has planned broadly. It has its own drafting, engineering and superintendent forces, its own offices, and its own entity throughout. As an Association it has no capital stock; the rights, interests, privileges and liabilities of every member are equal, and no member can have or acquire a greater interest therein, nor be subject to a greater liability, than any other member. A member is without interest in the assets of the Association other than that conferred by his membership; on termination of membership for any reason, all rights and interests of the member in the assets of the Association cease. Any gains the organization may make will be principally expended in those things that will be of aid to all architects in their professional duties, such as a comprehensive architectural library, meeting rooms and educational facilities for draftsmen. It is intended that only the most nominal gains will accrue to the membership; hence, a membership is attractive and will be confined to those architects only who are in sympathy with the idea of this Association and the opportunity it offers to give public service, and who have achieved the qualifications for membership. The by-laws so express this point: 'Any architect who, because of his ability and qualifications has advanced the art and profession of architecture and is especially fitted to render professional services for public welfare, is eligible as a member of this Association.'

"The membership is open to those individual architects who have achieved these high qualifications; by application to and approval of the Board of Directors and 90 per cent of the entire membership, such an architect becomes a member of this organization and, as evidence of such election, the certificate of the Association is issued to him. The membership is safeguarded from those who fail to fulfill the loyal service demanded or who find the work irksome or not to their taste; a membership can be terminated (a) by resignation of the member, (b) because of dereliction of duty to the Association or other cause by a vote of 75 per cent of the members, or (c) for any reason, by a vote of 90 per cent.

"The cost of membership has been put at the nominal fee of $100; this has been fixed in the charter of the Association, so that the entrance of any architect to the Association will not be barred by its cost. The Association desires the personal services of its members, not their money. The members will be compensated for their services to the Association.

Duties of Members. "It is not expected that the duties of the members will be onerous, but there are no qualifications in this respect. Every member has signed this document on the books of the Association: 'I hereby acknowledge that I have read the Articles of Incorporation and the by-laws of this Association, and I do promise and agree that I will comply with and uphold the principles and aims of this Association as expressed in them. I further promise and agree that I will render promptly, diligently and faithfully to the Association such personal service as may be assigned to me by the Board of Directors, and for the compensation, if any, allowed by them, and will endeavor, to the best of my ability, to work harmoniously and unselfishly with my fellow members of this Association.'

Los Angeles Hall of Justice
The Allied Architects Association of Los Angeles, Architects

The Control and Administration. "The business and the property of the Association are conducted, managed and controlled by the Board of Directors. Those first elected were:

OCTAVIUS MORGAN — REGINALD JOHNSON
EDWIN BERGSTROM — DAVID C. ALLISON
MYRON HUNT

The officers first elected were:

OCTAVIUS MORGAN ..... *President*
EDWIN BERGSTROM ..... *1st Vice-president*
DAVID C. ALLISON ..... *2nd Vice-president*
H. M. PATTERSON ..... *Treasurer*
J. J. BACKUS ..... *Secretary*

Both directors and officers are subject to immediate removal for neglect of duty or other causes.

"The administration of the work of the Association and the operation of its departments are in accordance with the most efficient and economical practice; its chief divergence from the ordinary practice is its machinery for securing the collective criticism and service of its members. The talented designers, those men who have really been educated to know and understand the good things in architecture and to express them, those men who too infrequently have the opportunity to function on public work, will be afforded the opportunity by this Association, and the member whose qualifications most fit him for the work in hand will function most strongly on that work, and every member will contribute his ability to the work of the Association under the direction of the Board of Directors.

"The practical sides of the undertaking, as well as the æsthetic, are fully cared for; the Association gives its most experienced minds to exercise the business and executive functions and to care for the structural, mechanical, electrical, architectural, sanitary and supervising problems. Its carefully selected and rounded out membership gives, in every branch of architectural work, a collective service that no private individual, firm or corporation can buy.

"The individualistic touch is necessary to all architecture and to every art; without it there is no life or interest. So in this association, this touch can never be lost, because the method of organization under which it operates provides that some individual member will always have the architectural expression of the problem, under and subject to the criticism of his co-workers.

"The Board of Directors shall have power to enter into contracts, acquire and assume obligations and to borrow money, make or issue notes, bills or evidences of indebtedness in the manner provided by law. The Board of Directors shall have full power and authority to require members to perform services assigned to them by said board and upon the failure, refusal or neglect of any member to perform the same, said board shall have power, upon being directed so to do by a vote of three-fourths of all the members expressed by letter ballot, to forfeit all interests and rights of such member in said Association.

Compensation of Directors. "There shall be no compensation paid to any director for attendance at any meeting of the board or of the members.

Power to Fix Compensation. "The directors shall have the power and authority, and it shall be their duty, to fix the compensation to be paid to members of the Association for their individual services rendered to the Association, and to fix the compensation to be paid to its officers, representatives and employes.

Division and Application of Profits. "Profits acquired by the Association shall be divided in the month of January of each year among the members whose membership has been continuous for a period of one year prior to the date of said division and shall be deemed to be the amount of funds determined by the Board of Directors as available for division after all expenses of the Association have been paid, including payments to members for services rendered and amounts not required for conducting the affairs of the Association. Every member signs a waiver of all his rights to the Association."

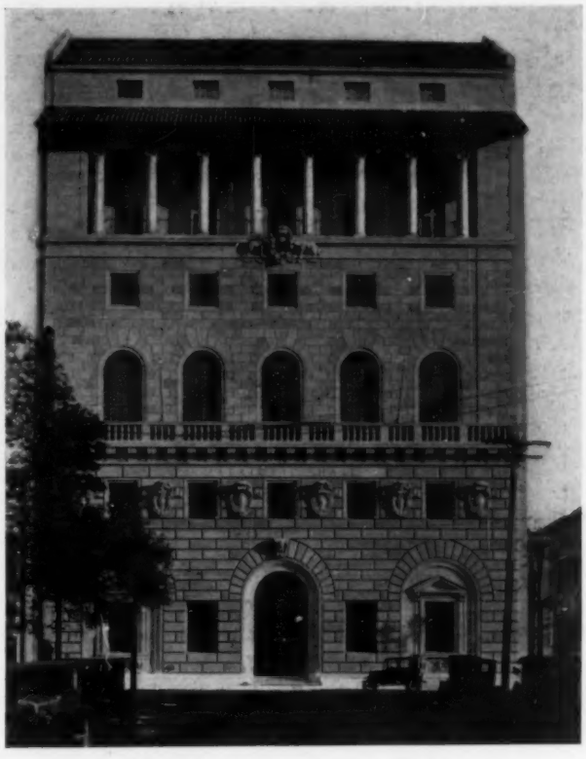
Reasons for the Form of Organization. The architects organizing the Association were all members of the American Institute of Architects. The doing of this work in this manner was discussed in chapter and committees. It was found entirely impractical to do the kind of work that it seemed best to do through the chapter organization of the Institute. The service of members to the chapter is compulsory because of membership therein; the services ren-

dered by members to the Association are entirely voluntary;—the chapter executives are ever-changing; the responsibilities of the practice of architecture require unchanging executives;—the chapter is a branch of a national body and therefore is not an organization organized for profits or one that can assume the responsibilities and liabilities of a business organization. If the chapter should assume business obligations, the Institute would become involved in its financial problem without doubt, and thereby would be created a situation impossible for the Institute. The Allied Architects Association organization is incorporated under the laws of California. The indebtedness which the Association may incur is limited in the by-laws to $20,000.

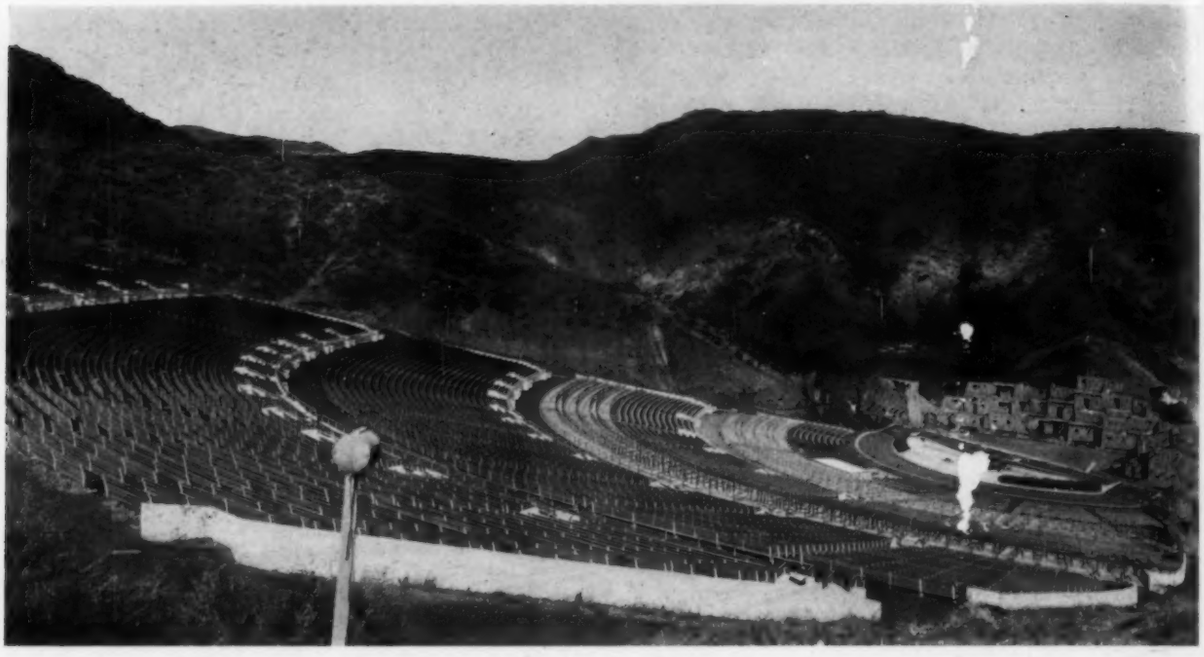
Avoiding Pitfalls. In the organization care was taken to avoid some of the pitfalls that seemed to have caused other altruistic associations of architects to fail. The organizers studied carefully all available data regarding several of these attempts and visited several of the localities where attempts had been made to render collective architectural services. How well the present organization has avoided these causes of failure is evidenced by the fact that this organization has been functioning for six and one-half years, has completed some very important commissions, has continuing contracts for several years to come, and has the continued enthusiastic interest of its members.

Fees, and Payments on Contracts. The organization gives its combined services for a single fee and performs its work through its own complete organization down to the very last detail of practice. Its contracts have been based on a 6 per cent fee, modified by the extent of the services rendered, and in all respects have been exceptionally fair and equitable contracts for architectural services for public buildings. The contracts provide and complete preliminary sketches (which, when accepted by the public body, can be deviated from only as the development of the working drawing compels modifications or as the public body may by resolution require); the preparation of the working drawings and specifications; the preparation of the contract documents and the construction contracts; bonds and insurance instruments; and the supervision and superintendence of the work. Payments to the architects become due as the services of the architects progress, and are payable monthly beginning with the performance of service, the amount due being based on preliminary estimates of the cost of the building, fixed by the public body, until such time as the actual costs of the building are determined, when any necessary adjustments in fee are made. The contracts provide for various additional services that may be rendered by the architects in addition to those on which the basic fee is computed and an equitable charge therefore in addition to the basic fee.

Procedure in Actual Work. The functioning of the organization has really been very simple. The Board of Directors, after signing a contract for a project, sends a written statement to the members outlining the requirements of the building as fixed by the public body, and requesting each member to submit at an open meeting of the Association, in any manner he desires, his ideas of the proper solution of this problem. The various suggestions and sketches submitted by the members are thoroughly discussed at meetings of all members, at which the public officials are always present. Often the discussions, in which the officials take part, run over three or four such meetings. It has been easy for the members and officials by this open discussion to arrive at two or three possible solutions of the problem, any one of which might be proper. These two or three tentative solutions have then been returned to each of the members, asking them again for their criticisms and suggestions. These are re-assembled, and again at open meetings these second offerings are considered and out of the discussion of these, always with the public officials present, there has been no difficulty in selecting the *parti*. When this scheme has thus been decided by the members and officials, the Board of Directors appoints one of the members to take personal charge of the design and the working out of the *parti* into a final design. The board criticises the design as it grows, and also appoints a small number of its members as a jury of design. The board selects for both designer and the jury, those members who, in its judgment can best solve the particular problem in sympathy with the general solution decided upon by the membership. Thus the final *parti* is worked out of many sugges-



Patriotic Hall of Los Angeles
The Allied Architects Association of Los Angeles, Architects



Hollywood Bowl
Allied Architects Association of Los Angeles, Architects

tions offered by the members and is the result of many full and free criticisms of them by the entire membership and the public officials. The development of the selected solution is placed in the hands of the men most competent to develop the particular *parti*, whether or not he may have submitted the approved scheme, and associated with him are those members who will work sympathetically. The Association has found, and the designers admit, that the designer has invariably profited by the sympathetic criticism of his jury and in the final design there is no question but that the individuality of the designer has been preserved and that the design has gained by the jury criticism.

As the design is developed by the designer, the drawings are brought up one or more times before a general meeting of the members and officials to be freely criticised, and as a final step they are brought to the Board of Directors and must receive its criticism and approval before they receive the stamp of the Association as the final design and final solution. All work of drafting and preparing of documents is done in the drafting room and offices of the Association by its own staff. No work is apportioned out to any member. The designer and the jury invariably develop the design in the drafting rooms of the Association. For the development of the working drawings, further juries of the members are brought into active work. There is a permanent jury of engineering and a permanent jury of specifications whose duty it is to meet with the designer and jury of design and discuss and fix upon the construction and materials and to criticise the development of the structural drawings and the preparation of the specifications, and finally, after the designer has approved them, to approve them in writing to the board whose final approval must be had.

Supervision. Responsibility for the direct supervision of the work of construction is always maintained in the Board of Directors, which delegates one of its members to supervise a project, and this member and the designer and the chairman of the jury of construction and specifications meet regularly at the building for inspecting purposes and to give directions to the general superintendent of the Association who is in direct charge of the field work for the Association. The final acceptance of work of construction is on the signatures of these members.

Office Methods. The offices and drafting room of the Association are organized to give complete service, the drafting room carrying its own sanitary, electrical, mechanical and acoustical engineers. The Association calls in as advisers on special problems the best outside talent available.

The general office of the Association has been fully organized, and the accounting department has developed very valuable and exhaustive forms whereby the costs of doing work have been established down to the finest details for the purposes of record and efficiency. The general office, in consultation with various counsel, has developed full and complete contract agreements for the use of contractors and public bodies on public buildings, which are receiving wide application because of their full detail requirements. Approximately 200 forms have been worked out and are in use by the Association in connection with its work, and these forms are invaluable.

Budget. As soon as a project is contracted for by the Association, the board prepares a budget for the work wherein it distributes the probable amount

Preliminary Study, Acute Unit of the Los Angeles County General Hospital
Allied Architects Association of Los Angeles, Architects

of the fee to reserve, preliminary work, working drawings, supervision and superintendence, and general expenses. The limits of the expenditures set by this budget for the development of the various portions of the work control the drafting and other costs.

Payment of Members. The profits distributed to the members as such have been very nominal, amounting in the aggregate to approximately the amount of the membership fee. The payment of the members for services has been on an hourly basis at a rate which has been established by the Board of Directors, the rate being the same for every member. The number of hours of service given by each member is kept by the Association, and the total amount of compensation received by the member for any service performed by him for the Association, whether it be on the architectural or engineering problems or on the development work of the Association, and also the spending its reserve, are determined by the Board of Directors by fixing the number of hours.

Political and Legal Difficulties. The Association, functioning on public work, is subject to political attack at all times, and like any association, must expect to have its motives questioned, its compensation questioned, and its legality in service assailed. The Los Angeles Association has been the subject of violent political attack, culminating in 1926 in forcing the Attorney General of the State of California to bring *quo warranto* proceedings against it asserting that its organization was illegal, that it was illegally performing architectural services, and that the service which it was performing could be performed by individuals only, seeking to enjoin it from performing further services, and the County of Los Angeles from making further payments under its contracts. These proceedings were heard in the Superior Court and injunction denied without leave to amend. The decision was appealed to the Supreme Court of California, and in July, 1927 a unanimous opinion of the Supreme Court written by the Chief Justice upheld in every particular the decision of the Superior Court and set out that the Association was legally incorporated and as an Association could render full and complete architectural services so long as its members were licensed architects under the laws of California. The legal status and responsibilities of the Association were thus finally established by the highest court authority, and the decision was far-reaching in its effects upon the question of associations of architects, whether of two or 50, and incorporations of architects performing architectural services. The litigation has been long and costly to the Association, but it has borne the expense because it felt that the question should be settled as to the responsibility and qualifications of associations and incorporations to perform architectural services, and because it felt that the service it was rendering to the public was of such importance that it should be continued if possible.

Results of the Work. The gains which the Association has obtained by its business have been entirely expended for the betterment of the architectural profession and for the development in the community of an appreciation of architectural service and architectural design. This has been done in many ways, and two of its most lasting of efforts will be the encouragement it has given to architectural education in the local colleges and appreciation of design in the schools and the development of an architectural

library open to the public under charge of competent librarians.

The work which the Association has done in these years includes:

(1) Giving advice regarding various public works and enterprises, such as the Los Angeles Colisseum, restoration of the San Fernando Mission, and architectural features of the Los Angeles city viaducts.

(2) Forming for the City and County of Los Angeles a plan and scheme for development of an administration center.

(3) Work on the exterior of the Hall of Justice; Los Angeles Museum of History, Science and Art; Patriotic Hall; acute unit of the Los Angeles County General Hospital; acute unit of the Olive View Sanitarium; three playground buildings for the Playground Department of the City of Los Angeles; and development of the Hollywood Bowl.

Complete preliminary sketches, working drawings, plans and specifications have been prepared for all of the buildings and structures itemized under (3).

The essentials of the success of a similar enterprise based on the experiences of this Association would seem to be these:

First. The rendering of public service in order to achieve better public buildings must be constantly adhered to and upheld as the paramount purpose of the organization. It is essential that the organization must be kept altruistic in its nature and that the members must always have the feeling that they are giving something to public service and giving more than they are being compensated for.

Second. The work of the Association must be limited strictly to public work in order that the private practice of a member shall not be infringed upon. An Association would have no excuse for functioning if the public work in its locality were being adequately done or if its objects were to cut out competition, or if it were necessary for it to engage in the usual political maneuverings to obtain its work. The Association, an association, to perform public service, must be politically above criticism.

Third. Every member must be paid for the time he puts into the organization, regardless of what the rate of compensation may be, and each member must be paid at the same rate as every other member, regardless of his ability, in order that the equality of his rights as partner may be unquestioned.

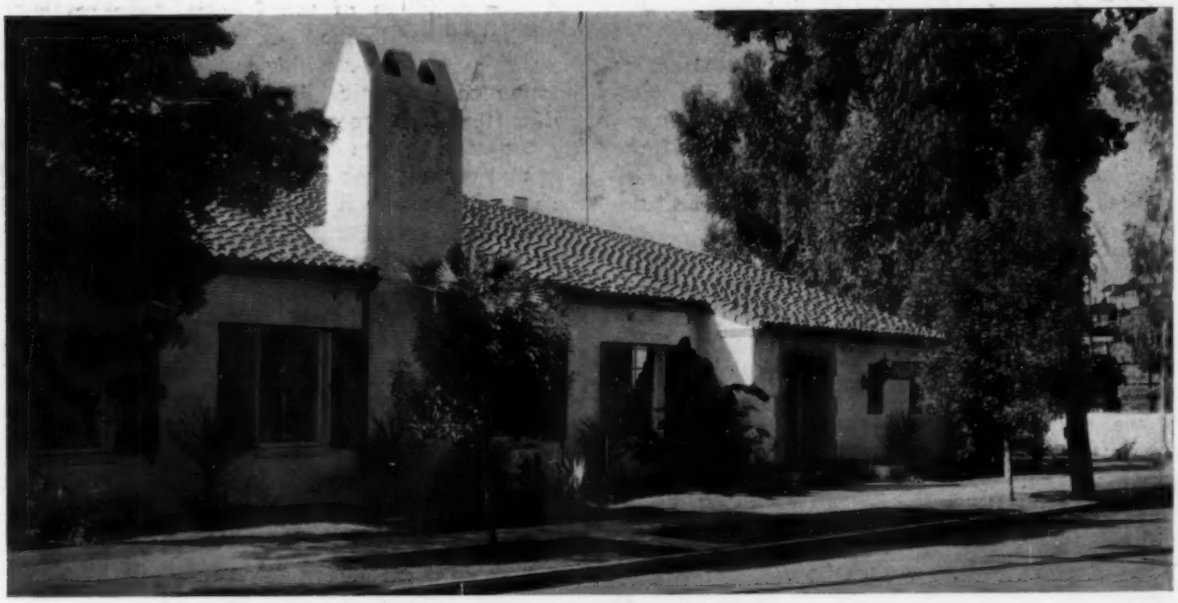
Fourth. The organization must be made representative of all abilities and qualifications, so that at some time or other every member will be able to contribute something to its success.

Fifth. Frequent meetings must be held to discuss all details of the work and problems in hand so that each partner will be kept personally interested.

Sixth. The actual work must never be apportioned out to members; complete architectural organization must be kept and maintained during the progress.

Seventh. As the objective of the organization is to provide better public architecture, it cannot be an organization for individual profit to its members; and the expenditure of any surplus funds the organization may accumulate must be made so as to accrue to benefit the architectural profession as a whole. In this case profits are being expended, first, on the building up of a working library of fine arts; second, in a development of fine arts educational system in southern California and the founding of scholarships; third, a development of public appreciation of the arts of design and architecture.

Eighth. Each member must voluntarily relinquish any interest that his estate might have in the assets of the organization, insofar as he can legally do so, and request that any such assets that have accumulated to him shall accrue to the benefit of the Association as a whole.



Los Angeles Playground Building

Allied Architects Association of Los Angeles, Architects

THE ALLIED ARCHITECTS ASSOCIATION OF COLUMBUS, LTD.

BY
W. A. PAINE

THE Allied Architects Association of Columbus, Ltd., was formed in February, 1924. The office of the Association is located in Columbus, O. The purpose of this Association is to provide by professional coöperation and collaboration architectural services for the design and construction of a city hall for Columbus and for such other public buildings and improvements in Columbus and Franklin County, paid for by the proceeds of taxation, as because of their civic importance seem to merit the efforts of a group of architects, and to perform such architectural service in a manner to advance the art of architecture and to contribute to the public good.

In the latter part of the year 1923 the City Council of Columbus requested the Columbus Chapter of the American Institute of Architects to advise it as to how to proceed in securing the best architectural service for the proposed new city hall. A committee from the Chapter was appointed to take up this matter and make recommendations. Various possibilities were presented, among them being an association of architects who would work together in an effort to give the city the benefit of the combined talent of the architects of Columbus. This suggestion was favorably received by the Council, and the Chapter proceeded to form the organization known as the Allied Architects Association of Columbus, Ltd. Opportunity was given all practicing architects in Columbus and Franklin County, whether or not belonging to the American Institute of Architects, to make application for membership in the new organization, and the project was thoroughly discussed at an open meeting of the Chapter to which all architects of Columbus

City Hall, Columbus, O.
The Allied Architects Association of Columbus, Ltd., Architects

were invited. Under the Ohio laws, an incorporation was found impossible, and a partnership association limited by statute to 25 members was adopted as the best method of organization. A nucleus of 12 members was elected at a Chapter meeting, and these members elected the remaining 13 from among those who had made application for membership.

The amount of capital stock subscribed by each member was fixed at $200, making a total of $5,000. The affairs of the organization have been conducted by a board of five managers, elected by the membership. The board elects its own officers, consisting of president, vice-president, secretary and treasurer. Since the specific purpose of the Association, as set forth in its by-laws, was to provide architectural service for a new city hall, as authorized by the City Council, and for other public buildings paid for by the proceeds of taxation, no effort has been made to obtain work or publicity. The design of those buildings already undertaken has been determined by a paid competition among the members, the winner being appointed to act as chairman of the committee on design, with compensation determined by the board of managers. The board of managers organized its own office, selecting a production manager, a stenographer and draftsmen. Careful supervision is had by the board over all work in the office, and board meetings are held regularly each week, at which all matters requiring its attention are acted upon. An executive committee, consisting of two members of the board, passes on matters which do not require the action of the full board. Special work is assigned to different members of the Association, when occasion arises. All special work receives remuneration fixed by the board of managers. The by-laws, however, stipulate that the members of the board are not to receive compensation for attendance at the meetings of the board.

The standard form of contract of the American Institute of Architects is used, and the usual fees of 5 and 6 per cent are charged, depending on the size of the building involved. When separate contracts are let, an additional fee of 2½ per cent is charged. On large buildings the contract calls for a clerk of the works to be employed by the owner. Each year a certified public accountant examines the books of the Association and makes a written report. The bookkeeping is of a simple character, but careful cost records are kept for each project. As provided in the by-laws, any and all profits derived from the conducting of the business of the Association may be divided among the members at such times and in such amounts as the board of managers may see fit and arrange for, and the board may divide and apportion parts of such profits among persons other than members for valuable considerations or for reasons that may be deemed sufficient by said board of managers, subject to the approval of a majority of the members. So far it has not seemed desirable to divide any of the profits among the members beyond the payment regularly each year of 6 per cent on the stock and the payment of a special extra dividend of 100 per cent on the stock at the end of the third year.

The Association holds itself in readiness to serve the city of Columbus in every way possible. In some cases advice and suggestions involving some expense have been furnished without charge, as a matter of civic interest. A substantial contribution has been made to the Lake Forest Scholarship Fund for students of architecture and landscape architecture. The legal responsibilities of the Association are those placed by the law of the state of Ohio on partnerships doing business in the state. The commissions awarded to the Association are: Cleveland Avenue Fire Engine House, cost $29,000, completed in 1925; City Hall, cost $1,200,000, to be completed early in 1928; Sub-station, cost $16,500, completed in 1927; Public Safety Building, estimated cost $900,000; and the Northmoor Fire Engine House, estimated cost $25,000.

So far all of the work of the Association has been successful. It is perhaps too early to claim complete success, because the city is only part way through a building program. Public work is often attended by difficulties and delays caused by lack of funds, and Columbus is no exception to the rule. Gradually, however, difficulties are being ironed out.

The advantages of an Allied Architects Association as they are seen here are: (a) The development of the ideas of a number of architects on any given problem by holding a competition for the project. (b) The interchange of suggestions, both as to design and in regard to practical matters of construction, engineering and mechanical equipment. (c) The confidence inspired in city officials and the public by the sincere and harmonious collaboration of a group of professional men on public buildings. (d) The personal pleasure and interest that each member of such a group obtains from working together. (e) The potential benefit that may be rendered to the community, not only by the high character of the actual service given in the production of well planned and well designed public buildings, but also by the application of any gains made by the organization to the advancement of architectural education and the increase of appreciation of good architecture.

Certain disadvantages of this form of organization have been cited by its opponents:

(a) It deprives the privately conducted offices of work that they might otherwise obtain.

(b) The work done by a group of architects loses the individual character that would be given to it if designed by one architect or firm of architects.

(c) There is difficulty in holding the interest of all the members of so large a group.

These disadvantages assume greater or less importance depending on the conditions under which the group operates and the type of men composing its membership. The Columbus "Allied" believes that these objections do not obtain to any great extent in its organization.

SUPERVISING THE SANITARY INSTALLATION

BY

A. R. McGONEGAL

MEMBER AMERICAN SOCIETY OF SANITARY ENGINEERS

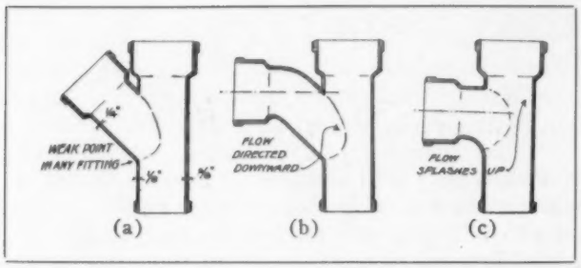
TIME was when a plumber was an artisan in more than the sense of being a worker at the business of installing pipes to carry in the water supply and to carry waste and sewage out. Much of this work was in lead, as his trade name indicates, and he made his own traps, flanges and sometimes pipe, cast his tacks or fastening plates, made his solder, took great pains with his wiped joints, and generally prided himself on his handiwork of the trade. An order to such a man to install plumbing in a house carried with it assurance of work well done. Specifications, minutely detailing the work in hand and the results expected, were not necessary. He made his own specifications as he went along, and when the work was finished it represented his level best,—a monument to his ability and artistry as a craftsman. And he built his business on his reputation for good work and fair dealing, and not on his ability to submit low estimates!

There is, however, another side to the picture. The symmetrically installed lead pipes, sturdily fixed in place, embellished with immaculate blacked and silver-wiped solder joints, all too frequently constituted a menace to the health and longevity of the householder. Perhaps not so much in the country and sparsely settled districts, but certainly so in the crowded sections of a great city. The journeyman or master in lead was not always a journeyman or master in sanitation. While lead was long used for underground water supplies, it was rarely used for drains, they being generally of brick, stone or tile. It is only just beyond the memory of men now living that cast iron pipes began to be used for drainage purposes, and, after proving their worth for several years underground, then for vertical lines outside and inside buildings, practically limiting lead to branch lines.

Prior to the early years of the nineteenth century, what we may call plumbing was a ground floor proposition, and mostly out of the house proper, so that lack of ventilation, loss of a trap seal, a by-pass here and there, and other sins against sanitation were not of very great moment; but with the advent of cast iron pipe came plumbing fixtures within the house and above the ground floor, and adherence to sanitary principles was a necessity. At first the fixtures were inside and the pipe was run outside, but even then it was seen that the pipe must be open at the top in order to prevent syphonage of the trap seals, and to avoid odors the open pipe was extended above the eaves of the roof. All plumbers did not carry the pipe up, some claiming it unnecessary, and out of the complaints as to variance in trade practice was born the first plumbing regulation. It was first enforced by the "guilds," as the plumbers' associations or unions were then known, and later by the health officers, and it is today one of the five cardinal points on which all plumbing regulations are built and enforced by our plumbing inspectors.

The Plumbing Contractor and Low Bids. The entry into the plumbing field of cast iron pipes, and later of rolled and welded pipes, has had the effect of gradually eliminating the artisan from the business and supplanting him with fitters. The use of such pipes and stock fittings naturally tends to standardization, and the necessity for and enforcement of plumbing rules also lead to the same end, so that as the need for artistry in workmanship disappeared, skill in designing, ability to direct workers, ingenuity in saving space and labor, and similar talents became of moment. These attributes, together with buying ability, business system and financial resources, are what should be the only reasons for difference in bids today. Unfortunately, much of the material used in plumbing work, especially the hidden portion, is costly as to the metal itself or else it is used in such quantity as to be costly in the aggregate. Generally speaking, the base material costs all manufacturers the same,—the potters' or moulders' organization sees that the unit labor cost is the same, and delivery costs are pretty much alike, so that any sales advantage must be carved out of business overhead and dividends. This leads to paring weights down so that the weight used is the minimum instead of an average, as it should be, and advantage is had in saving in total tonnage output; to the substitution of more of a cheaper metal in alloys; to thinning down castings and even bearing surfaces; and generally cheapening the basic materials a plumber works with, through a fault in the system of supply and demand, of which he has only a hazy idea.

If pipe of a certain stock pattern will cut and calk or thread well and is acceptable to the city inspector, why should the plumbing contractor be interested if the pipe averages 3 per cent short of regulation weight, provided he can buy it a cent a foot cheaper in carload lots than he can some other make? If the stuffing box on one valve is much smaller than on another and it is $100 cheaper for the lot, the price is the important point, as the work will be completed and turned over to the owner before the valve needs repacking or repair. Then, too, much of the material on a large project is purchased by a price clerk or office man with no practical knowledge. The head of a large plumbing and heating contracting business cannot look after the little details of purchase and supply. He usually has no intention of skimping the work in any important particular, but in these days of close competitive bidding he must take advantage of every little item so as to



(a) Weak fitting; wall not the same thickness all around
(b) Properly directed flow in a long turn T-Y
(c) Poorly directed flow in short T-Y branch

permit him to make a lower offer than his brothers.

Cost and the Specification. Specifications are also frequently so worded as to allow substitution of good but cheaper materials, and it is considered quite legitimate to take advantage of such opportunities; but there are, unfortunately, plumbing concerns with a reputation for being tricky, a reputation earned by perhaps years of substitution and deceit. Of these there is need to warn, for if they are given a contract at a price below estimate and cost, there is little chance of inspection being close enough to force work from them which will stand through the years, unless an inspector is set over every workman and all materials are tested on delivery.

The plumbing code of your city prescribes a MINIMUM quality of materials and workmanship, and the rules cover the OUTLINE of a proper plumbing system. It is the city inspector's duty to see that you have this minimum with certain trade allowances, and that your system conforms reasonably closely to the outlines planned and, finally, that the system is water- and gas-tight at the time of inspection. A reasonably good system of plumbing should be better than the minimum in both quality of materials and workmanship, and in the little details which go to make the system satisfactory and workable. It is the duty of the architect to take care of this through complete and clear specifications, and it is the duty of his construction inspector to see that they are carried out. Many plumbing specifications are long and involved, contain many "saving clauses," and generally go much into detail about those things covered by regulations, trade conditions or practice, and are singularly vague on the details which really go to make for ultimate satisfaction in the operation and freedom from repair needs of the finished work. This leads to necessity and pay for extra work and is where the vigilance and attention to detail on the part of the construction inspector will be of value,—and a word of advice to him will not be amiss.

A System for the Architect's Superintendent. On a large project, system from the start will save much in the end. Where there is a record of every transaction, every instruction given, every interpretation of specification, and a written memorandum of every occurrence having a bearing on the orderly prosecution of the work, there can be no argument as to a dimly remembered oral statement. The keeping of such a record is a comparatively simple matter, if it is adhered to. One large engineering firm furnishes its inspectors with small duplicating books very much like the order pad used in the corner grocery. Every time a question is put up to the inspector, he replies in writing, giving the original to the workman and noting the man's name and the time on the duplicate in his book. The slips are numbered consecutively, so as to check against loss; spoiled slips are marked; the book is filed in the office, and each night a brief reference is made to it on the record and report sheet, and it is indexed against the specification clause number bearing on the matter. At any time in the future, on a question as to the meaning of any specification provision, all notes bearing on it can be immediately located in the original duplicates, made at the time and not simply copied down later, in some report from memory. These order pads, with any lettering, printed in black ink for originals and in red for duplicates, on rough common paper set in the book in alternate leaves and with carbon paper attached, can be purchased in quantity very cheaply from those who make a specialty of supplying them.

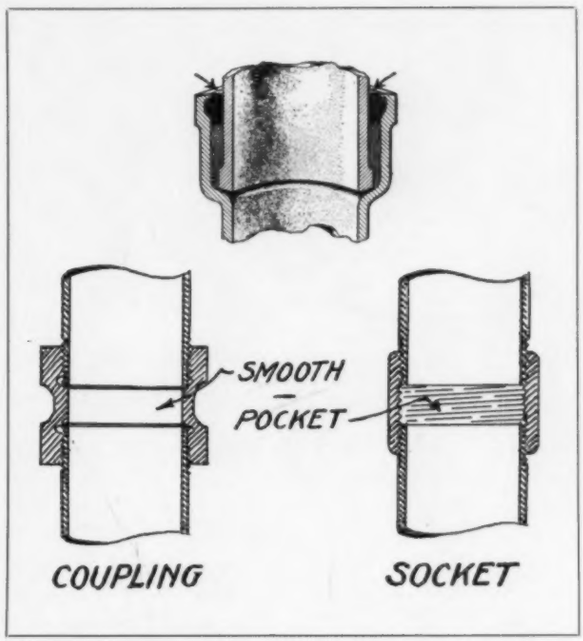
Inspecting the Sewer Work. The construction inspector will have little cause to check the plumber during the preliminary work, and he may safely leave inspection of the run of sewer and its grades and testing to the city inspector. He should, however, make a cursory examination of the character of cast iron pipe and fittings delivered on the work, noting that the weight generally and the wall thickness of the fittings are the same as those of the pipe, as fittings are more often skimped than pipe, and weakness in a branch may develop after completion of the work and cause much damage. Pipe of unequal thickness of wall, the inner and outer circles not being concentric, should be thrown out. This defect is more common than is generally supposed and is due to improper placing of the core, or to falling of the core in the mould just before casting. It can be readily detected at the spigot end. In large buildings, foundations have probably been carried down so sewer work cannot affect them, but where foundations rest on the ground at sewer level or above, care should be taken to keep sewer lines reasonably far away, and in the case of piers, equi-distant, if possible. Foundations are sometimes affected by the looser earth of a pipe ditch becoming an intermittent water course which keeps the surrounding area wet or alternately wet and dry and throws it out of balance with dry areas of supporting ground.

It should not be necessary to caution about the danger from vibration where pipes are passed through main walls and built in solid, but such construction is rather frequent. The plumber builds in his sleeve, and after the pipe has been passed through it, the builder fills in between the sleeve and the pipe with cement mortar. This fill should always be made with a bituminous compound of some sort, and the finish can easily be made by sliding metal collars.

In case a sewer ditch is dug deeper than the final grade of sewer, it is well to require that it be supported at proper intervals by concrete yokes, piers, or other workmanlike means to spread the weight on solid ground and not on a loose refill. This requirement is usual in city codes and is sometimes in specifications; but it is rarely carried out, though it is important that it should be.

Preventing Stoppage. The inspector can insure the sewer against future stoppages, if he will see that all openings in the sewer are kept closed except when actually being worked on. Regular test plugs, caps, or turned wooden plugs should be used for this purpose. Temporary closing with rags, wads of paper, excelsior, brickbats, and similar makeshifts is almost as bad as leaving an open end, as they frequently wash or fall into the pipe and catch at some point to gradually build up an obstruction that may not be evident until after completion of the building, and then cause an expense of thousands of dollars. The same care should be extended to all pipe openings throughout the building, and eternal vigilance is the price of a clean sewer line and stack installation. If stacks are not carried up ahead of masonry, bricklayers' chips, mortar splashings, drippings from floor pourings, sticks and blocks from forms and similar debris find lodgement in the open pipe, fall down the vertical, and catch in the offsets and the horizontal lines. Terrazzo polishers and floor finishers generally are the greatest offenders and are hard to cure of the habit of pouring the cement washings down the nearest stack line. Millions of dollars are wasted annually in old and new buildings in cutting out traps, pipe and fittings found partly filled with dried and set cement washings.

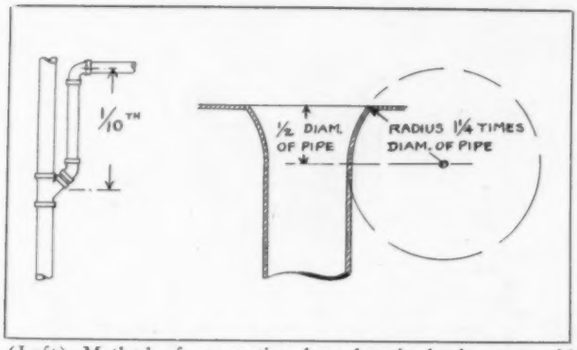
Stacks and Branches. When the stacks and branches are run there are a great many opportunities for poor workmanship and some for substitution of materials, and the inspector should be especially vigilant. It is to be presumed that the specifications cover the important question as to whether the soil, waste and vent piping is to be extra heavy cast iron, galvanized steel, or genuine wrought iron galvanized. It is not the purpose of this article to draw distinctions between the advantages or disadvantages of using the three materials, but in deciding the question as to the best material to use, the architect and his construction inspector should consider the material of which the structure is to be built and select the pipe which will give the best service for the "reasonably-to-be-expected life of the building." This does not necessarily mean total life, but the number of years before a complete remodeling is necessary to bring it up to date. In the business section of a rapidly growing city, once magnificent structures are frequently pulled down in 15 or 20 years to make way for larger and more magnificent buildings, and some authorities have even estimated that the average life of a "skyscraper" is limited to 30 years. Not that the structure becomes dangerous, but that the time arrives when the cost of upkeep



(Above) Grooved hub to prevent "creeping" of lead joints
(Below) Smooth surface of coupling contrasting with vulnerable "pocket" of ordinary socket joint

overtakes its earning power, principally through extensive repairs to heating and plumbing equipment, elevators, and mechanical equipment generally. By making our piping system of pure lead or pure copper, providing for expansion, self-welding all joints, and completely insulating it from contact with building material through wrapping with an enduring damp- and decay-proof cover, we might be able to plumb our buildings to endure for hundreds of years; but, except in the case of a very few monumental buildings, this is unthinkable on account of the cost and the pipe space necessary. Brass pipe in the larger sizes and the fittings for it being beyond the usual purse, the choice is restricted to the first mentioned three kinds of pipe, and sufficient information can be obtained through trade sources to select intelligently that which will best answer the needs on the particular project.

Pipes and Joints. One argument against the use of cast iron pipe in tall buildings is the "creeping" of lead joints, so often heard of but rarely seen. If trouble of this kind is anticipated and cast iron is otherwise indicated but is frowned on for this alone, it is easy to specify the type of pipe with annular grooves cast inside the hub, which pipe can be furnished by any foundry. The lead cannot work out of this sort of a joint. There are substitute materials on the market to save the cost of handwork in calking, but they have not generally proved satisfactory. Either hot poured lead or pure lead wool, well calked, makes a satisfactory and permanent joint. Some architects object to the greater space occupied by the hubs of the cast pipe, projecting every 5 feet some 2½ inches more than the smooth wall of rolled pipe which can be cut in story-height



(Left) Method of connecting branch rain leader to avoid splashing and poor flow
(Right) Method of forming rain leader entrance at roof

lengths, allowing fittings to come in floor construction. It may be superfluous to note that all fittings on soil, waste or rainwater lines of galvanized steel or galvanized wrought iron should be of the recessed drainage pattern, though it is not necessary that they be themselves galvanized unless called for by the code or the specifications. The zinc coating is a very necessary protection to the rolled pipe, which by reason of its laminated structure is more subject to corrosion than the granular texture of the cast iron of which the fittings are made. Galvanizing simply adds about 60 per cent to the cost of the fittings without any corresponding benefit, and is apparently a survival of the day when it was the practice to have the fittings of the same finish as the pipe, without study as to the necessity of it. If not prohibited by code or otherwise, uncoated fittings, such as the heavy steam pattern, are suitable for use on vent lines, but heat-treated or malleable fittings must be galvanized, as the process changes the texture so as to require protection. Malleable fittings are always used on iron water or gas piping; therefore, fittings on such work will always be galvanized.

One refinement which can be, but rarely is, practiced, is to require that all exposed threads on the pipe be painted with red lead or asphaltum to protect them. Naturally, when pipe is threaded the zinc is cut off, leaving the steel or iron exposed to corrosion at the worst possible place, immediately at a joint where strain may develop. Some day the practice will be to have all fittings countersunk or recessed so as to protect threads, and until that time comes, protection of exposed threads is desirable. Nipples should match the pipe. If galvanized steel pipe is used, galvanized steel nipples will be in order, but if wrought iron pipe is specified, the construction inspector should see that the nipples are of the same material and preferably of the same make. All wrought iron nipples are plainly marked with knurling or letters, while steel nipples are not marked. See that the short nipples as well as the long are galvanized. There is quite a difference in cost between black and galvanized, and between steel and iron, and substitution is easy.

All rolled pipe for plumbers' use, whether steel or iron, is delivered with both ends of the length threaded, and with one thread protected by a band coupling commonly termed a "socket." This was originally furnished by the maker to protect the thread on the end commonly dragged in handling, and is a steel or iron band spun or rolled from the same material as the pipe and threaded clear through. The practice grew, and is prevalent in all but a few cities where the code forbids, of using the thread-protecting band sockets as couplings to connect the pipes on long runs. There are several reasons why this practice is bad. Dirt from handling frequently gets in the threads, they are often jammed in handling, and are threaded with a running or continuous thread instead of a taper thread such as all proper fittings have. A running thread does not make as tight a joint, is more likely to loosen under strain, and from the theory standpoint cannot make up into a permanent, gas-tight joint. In practice such a joint usually rusts tight unless there is much strain or vibration, and then it causes trouble by persistently breaking out in leaks. It leaves a slight pocket in the line to catch paper and solid matter and build up an obstruction, and finally, from a structural standpoint, it is undesirable because it is not only of the same laminated structured material as the pipe itself, but by reason of the method of making it, the grain is crossed. In any event, it cannot make up into as straight, true and tight a joint as a taper thread, cast recessed fitting, like the others in the line.

Fittings. Many city codes forbid the use of short turn fittings altogether; others permit them where the change in direction is from horizontal to vertical; but many of the city codes still permit their promiscuous use, though they are becoming stricter on this point each year. An abrupt change in direction from a horizontal line of pipe to a vertical drop might not be detrimental to the continued satisfactory functioning of the system, but if the specification or the code permits, the inspector should require that all branch lines discharging into a vertical main do so through a long-turn fitting partaking more or less of the nature of a combination of a "Y" and eighth-bend, and condemn the so-called "sanitary" tee, a short-turn pattern. If the vertical main is a vent above the fitting, the fixture discharge splashes against the back wall of the fitting, sprays up into the unwashed part, and tends to gradually build up a mound of greasy material or other solid matter until the vent is closed off and ceases to function. If the main is a soil or waste, the excess head of the discharge from above or the selectivity of a solid stream tends to bar entrance from the branch, the fixture discharge is sluggish, and the branch pipe is not sufficiently self-cleansing.

The use of the terms "long turn" and "short turn" simply refers to manufacturers' classification, and the radius usually follows no set standard. In fact, many cities prohibit a short-turn soil pipe fitting with a longer radius than a so-called long-turn screw pipe fitting, simply because of the maker's classification. In the case of the branch fittings, some codes

require that the top of the arch of inlet shall break through the wall of the running line at a point at or below the center line of the inlet. This appears to be ample for the purpose and does not require so much projection of the inlet branch as would be the case of a combined "Y" and eighth bend, but such a fitting should never be used to discharge a vertical waste into a horizontal running line.

Sleeves should be used where pipes pass through floors, as pipes should not, in any case, be cast in solidly when a concrete floor is poured; neither should stacks ever be built in solidly in chases or wall construction. Adequate support of the pipes themselves should be provided by yokes, suitably fastened to the pipes and resting on floors or other construction. Too often the weight of the stack is carried by the branch fittings, thus putting great strain on them. Pipes in a plumbing system are peculiarly subject to troubles caused by expansion and contraction and should never be built or cast in solid in concrete or other masonry. This is especially true of fittings. Not only does the index of expansion differ materially between the masonry and the pipes, but the pipes carry alternate volumes of warm sewer air, cold water, and even hot vapors.

In installing cast iron soil and waste stacks, joints should be straight to avoid leaving shoulders in the hubs, but with wrought pipe it is immaterial whether pipes are plumb, canted or offset. An exhaustive investigation by the Bureau of Standards indicates that regardless of height or of any slight variation from the vertical, the falling water-borne waste increases its velocity of fall at a normal rate of acceleration until the friction on the sides of the pipe becomes greater with the increase of velocity than the force produced by acceleration, and thereafter the rate of fall remains constant. In the experiments and deductions it is indicated that the rate of fall of fixture discharges in a stack of any height, even including that of the proposed 110-story building in New York, will not exceed some 28 to 32 feet per second, depending on conditions. This would not apply to rain leaders which might conceivably be running solid or under head. It does, however, give rise to speculation as to whether much smaller soil stacks could not be used in very large buildings, with much saving in space and cost of material. If the velocity in a 4-inch horizontal branch graded ¼-inch per foot is 3 feet per second, and the rate of fall in a stack is ten times that, then the stack could dispose of the discharge of ten branches loaded to capacity provided they discharge into the stack at different points, if capacity is arranged at the foot to get the total discharge away without interference with the flow from the stack; and the writer expects to see this practice exemplified in some larger buildings.

Rain Leaders. In the matter of interior rain leaders, the construction inspector is solely responsible for getting a good installation by the plumbing contractor. Outside of the matter of sizes, and a requirement that the roof connections be tight, the city code leaves it open, and rain leaders are seldom detailed in the plans, and only roughly covered by the specifications. It is up to the man on the work to look after some mighty important details of installation. One problem is that of getting an amount of roof water equivalent to the capacity of the downpipe into it. Slope and area of roof must be properly proportioned, but there is the loss of effective area due to entry through a right-angled orifice. This loss of effective area is about one-sixth for any constant velocity in the smaller sized pipes, but it can be eliminated and the full area of the downpipe utilized by spreading the top of the pipe out into a small, cone-shaped opening with curving sides. The height of the cone should be half the diameter of the pipe, and the radius of the curving sides one and a quarter times the diameter. A table covering the different sizes can be worked out and templates made, it being borne in mind that the sides of the inlet must be curved at the proper radius.

Showing marking on vitreous china fixture "culls" or seconds; two short parallel red lines where shown

If the code permits and the building is taller than its surroundings, with no roof garden or condition under which sewer air would be a nuisance, traps should be left off main rain leaders, only including them on leaders from courts, balconies and other surfaces lower than the main roof, and on main leaders which have branches from them. If they are necessary, it is better to group them, several on a trap. In those cities having combined sewer systems taking both rain water and sanitary drainage into the same mains, it is better construction to separate the two systems inside the building and join them in the house sewer outside the walls, increasing the size from that point. In such a case a single trap can be made to serve for all. Where branch rain leaders from courts, oriels, balconies or bays are connected into vertical leaders from the main roof, two conditions must be provided against,—the possibility of impounded air in the main line blowing out through the shorter branch and causing spouting, and the practical closing of the branch owing to solid streams of water in the main downpipe. Both of these conditions can be avoided by turning the branch down parallel to the main leader for some several feet, and then branching through a "Y" and

eighth bend. The vertical pipe run of the branch should be not less than one-tenth of the length of main pipe above the junction. Such a connection will tend to accelerate discharge from a branch line instead of to retard it, and will not require increasing size of leader unless the branch takes a large area.

Inspecting Roughing-in. In roughing-in or getting piping ready for fixture settings, too much stress cannot be placed on checking all measurements to some permanent point and level. The inspector should personally see that the journeyman has followed the manufacturer's directions as to measurements, and that all outlets are square or plumb as the case may be, and are left flush with the finished floor or wall line. The journeyman may say "I'll straighten that when the fixtures are set." The time to get the measurements right is at the time the pipe is installed, and insistence on this point will save regret later. In case of a large general toilet room, with the fixtures in battery, a template should be made of lumber for each battery, with the outlet centers plainly marked. Fixtures cannot be set square and gas-tight if the connections are not in the proper places, and the appearance and stability of the finished work depend on the faithfulness with which this portion of the work is handled and supervised.

Shower Pans and Other Connections. In case lead pans are used under the floor finish for shower compartments, the lead should be liberally coated with asphaltum on both sides before setting it in place; and after connecting the waste, it should be temporarily plugged and the pan kept full of water till the cement and tile are ready to put down. Dry pans are apt to develop leaks which do not show up till after completion and the shower is put in use, and the water contents have a tendency to prevent workmen from walking in them, using them for tool receptacles, and similar abuses. Many architects prefer a four- or five-ply tar paper and hot pitch shower pan to lead, but the continuous water test should be used just the same. If lead closet bends or stubs, or other lead connections are specified, they should be painted with asphaltum after test and wrapped with tar paper or sheet asbestos.

Quality of Fixtures. It is not often that plumbing contractors try to slip in "culls" or second grade vitreous plumbing fixtures, but if they do, it can easily be detected through the presence of two short parallel red lines at the top rears of closet bowls (sometimes under flushing spuds), on the sides of the basin bowls of lavatories, and on the inside backs of closet tanks just under the covers. Perfect ware is, of course, not practicable commercially, and certain minor defects are allowed in each piece. Classification of enameled iron ware is shown by pasted labels. It is suggested that Department of Commerce Bulletin No. 52, on "Staple Vitreous China Plumbing Fixtures" will be of interest to all construction inspectors. Substitutions which frequently occur when the fittings are not purchased with the earthenware fixtures, are composition lavatory, bath, and closet tank supplies, and nickel plated iron supplies and trap waste nipples to wall. These are easily detected.

Valves. The matter of valves rarely receives attention due a subject of such interest to the one who is to keep up repairs on the work. Every fixture in the building should be valved so that repair at any one fixture will not necessitate cutting a whole line out of service, and every riser or return line should be valved at the foot where it leaves or joins the main. Cross-connections between lines for emergency use should be as few as possible, and they should be grouped and valved so that operation and changes are all controlled at one point. If it is necessary that a valve in the combination be located at a distance, it should be motor-operated (no matter how small it is), and the operation and tell-tale located with the other valves. In a building of any size, all valves should be numbered, the piping and valves diagramed, and a copy furnished on completion. Valves buried in walls or floors should either be in suitable covered boxes or the bonnets should be so left that repairs can be made from the surface. Globe valves seriously interfere with flow of water, having something like 20 times the frictional coefficient of a gate valve of the same size, and if used at all on horizontal lines should be inserted in the line with the stem in a horizontal position so that the lines can be drained. The cost of repairing a small valve is equal to more than its first cost, so it is of paramount importance that the valves be selected with great care. It is also desirable in general to have all valves of a class of the same make.

Water Pipes. Water pipe sizes are usually fully covered in the specifications for the work; if not, it is the duty of the construction inspector to check the plumber's layout and see that the sizes are ample, especially the supplies to flush valves which require a rate of flow equal to about five times as many closet tanks. These larger sizes for flush valve operation generally apply only to sizes below 3-inch, as the principle of overlapping operation tends by reason of the short flush of the valve to overtake the size required for the longer tank fill. Every installation should have the sizes accurately figured, taking length of pipe, number of elbows, number and kinds of valves, and initial head or pressure into consideration. Nearly all makers of flush valves are glad to furnish formulæ and tables which facilitate the laying out of a suitable piping system. Care should be taken to keep velocities below a point that may cause singing in the pipes, and in large or high buildings, the judicious use of water-pressure regulators is recommended to keep pressures within reasonable limits. Water hammer can be guarded against by the use of shock absorbers, there being several on the market, at least one of which needs no relief pipe, repair or readjustment, and can be plastered over in the wall or floor construction after it has been once set. These shock absorbers take the place of the obsolete air-chamber, which soon after installation becomes waterlogged and of no effect, and fails to operate.

A WELL PLANNED ARCHITECTURAL OFFICE

THE OFFICE OF
B. H. WHINSTON

AN architect very rarely has the opportunity of finding an office space exactly suited to his needs. From his student days onward he always has his ideal office in mind; the scribbles on the edge of his first *projet* may be expressions of his dream of the office he will some day control, where clients will flock to see him and where he will diffuse the atmosphere of his own personality. When he at last has his diploma and begins to work over the drafting board in some established architect's office, his ideas concerning his own office are usually materially changed. He realizes that he must provide some space for contractors to look over blue prints and to take off quantities. He must also provide for waiting clients and salesmen.

In one of the smaller cities he may be able to build an attractive little office structure of his own, demonstrating his ability as a designer. In the larger cities he is usually forced to seek office space on some upper floor, and to adapt this space as well as he may to his purposes. In New York it may seem particularly difficult to obtain just the right light and space conditions. Mr. Whinston, whose office is here illustrated, searched high and low, and finally located a bare penthouse loft in a six-story office building. The loft was 28 feet square and 14 feet in height, with light on three sides. Usually, an office of this size has a meager supply of light from only one side. The penthouse had a large studio window on the north, which gave an ideal light for the workers in the drafting room. A window was installed in the south side, so that daylight is now admitted on all four sides.

One enters the office by ascending a small stair which opens directly into the reception room. The combined stenographer and switchboard operator controls this room and the entrances to the private office and the estimating room. The estimating room is strategically placed, so as to be directly available from the reception room for contractors, and from the drafting room, so that plans and information are easily available. A second door leading from the reception room admits one to the private office which, in turn, connects directly with the drafting room and with the library and sample room. The private office is finished in walnut pilasters and paneling. The panels above the doors and windows are appropriately decorated with plaques representing the various arts, such as sculpture, painting, architecture, music and poetry. The large panels give excellent settings to renderings of drawings and photographs of the architect's work. The ceiling is attractively coffered.

View of the Architect's Private Office

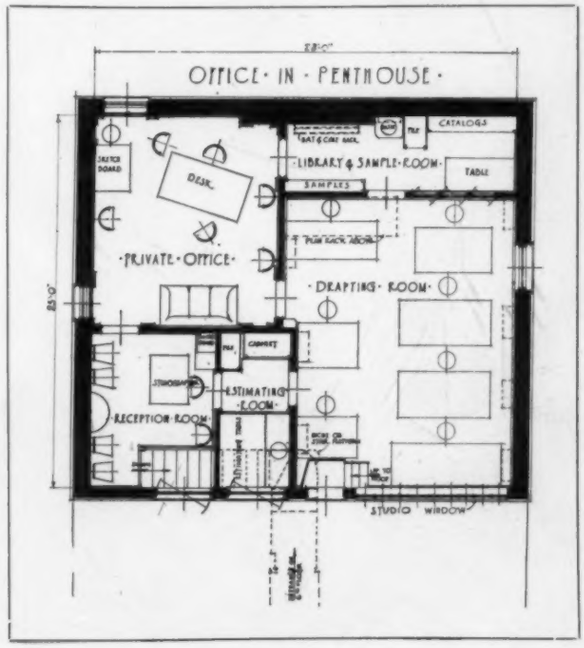
Private Office

Reception Room

The doors are interestingly treated with leaded glass, as are also the windows of this private office. The furnishings are comfortable and in keeping with the spirit of the room. The architect's private drafting table adds a note of the atelier and relieves any severity there may be. The reception room is treated in somewhat the same manner as the private office, as will be seen in these illustrations. The drafting room is equipped with tables having drawers for instruments, and at the side of each table is a rack for the keeping of those odds and ends that otherwise might collect on the drafting board itself. Obviously, in a drafting room of this size, it would have been unwise to devote floor space to the storage of plans and blue prints, so a plan rack occupies the space above one of the tables.

The office has an unusually compact and efficient plan. No space is wasted, and the general scheme has been evolved to make communication and accessibility contributing factors to the work of the office. The rooms have been made attractive and comfortable in a pleasing, intimate way.

A Corner of the Drafting Room



Plan of the Office